WILDLAND URBAN INTERFACE OPERATING PRINCIPLES

CALIFORNIA DEPARTMENT OF
FORESTRY AND FIRE PROTECTION

Wildland Urban Interface Operating Principles

California Department
of
Forestry and Fire protection

Wildland Urban Interface Operating Principles

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CONTENTS

Foreword

I hope the bobcat that leaped to my headlights and showed me the road I could not find in the smoke escaped the flames, too. If not for that wild creature, I likely wouldn't have survived the Cedar Fire—to date still the biggest in California history. It terrorized San Diego for a week in October 2003, destroying more than 2,200 homes, including mine, and killing 15 people, 12 of them my neighbors. The 15th victim, Steven Rucker, was a firefighter who'd traveled 500 miles to help protect the lives and property of people he didn't even know.

Now recognized among the first of a virulent new breed of megafires exacerbated by climate change, the Cedar Fire led the news and entered the history books not just for its great size and speed, but also for its remorseless incursion into suburban neighborhoods long assumed immune from the high fire risk associated with rural communities.

It happened again only 4 years later. Ten people died and 1,600 homes burned in simultaneous fires that struck the San Diego region in October 2007. Again, an affluent suburban community fell victim to fire sweeping in from adjacent wildlands.

As I write these words, San Diegans are once again emerging from a devastating firestorm. Over the past week, 10 separate fires fed by unseasonably strong Santa Ana winds have taxed firefighting resources and terrorized communities across San Diego County. At least one person is dead. More than 60 homes lie in heaps of rubble and buckled metal. Firefighters are exhausted from working long days and nights through triple-digit heat and single-digit humidity, buffeted by winds gusting as high as 50 mph. And it's only May.

What once we could legitimately categorize as unprecedented has become all too familiar, not only in San Diego, but also throughout California, across the United States, and around the globe. Climate change is no longer speculation or prediction. Climate change is here, altering the face of our planet and with it, fire regimes worldwide. Already we're experiencing longer and more frequent droughts, higher temperatures, and spreading infestations of timber-killing insects, all boosting the likelihood of catastrophic fires across our wildlands.

This text is a timely and welcome publication designed to better prepare fire professionals for the challenging task of fighting fire in the Wildland-Urban Interface (WUI), with its unique combination of wildfire attack and structure defense demands. The knowledge compiled in this volume can save property, but more importantly, lives—of both civilians and firefighters.

As trends in climate, demographics and economics continue to compound fire risks and losses, public awareness and involvement regarding wildfire will also expand. To be sure, after every incident, a small but vocal minority of the public will attempt to vent their pain by demanding explanations and projecting blame. Firefighters make easy targets for these injured souls, who need time and compassion as much as answers to their questions. I know; I was once one of them.

Take heart in realizing that the overwhelming majority of the citizens you have sworn to protect deeply respect and appreciate our firefighters. You are our real-life heroes. You rush into the smoke and heat even as we abandon our homes, hopefully to your care, always to uncertainty. We stand in awe of your courage. And when the smoke finally clears and we find our homes still standing amid blackened ground, we cannot find the words to properly thank you.

So we want you to be prepared—educated, equipped and informed—when the next fires come. Use this text to further that preparation. Be diligent in training; trust your instincts. Because most of all we want you to be safe, whether our properties survive the flames or not.

It is a devastating blow to lose a home to fire. I would not want to repeat the experience, and every time I see it happen to others, my heart breaks all over again. Yet those of us who choose to live in wildfire country willingly accept the inherent risk in exchange for uncommon beauty and tranquility. In that sense, perhaps we are not so different from firefighters, who embrace danger in return for adventure, camaraderie, challenge and satisfaction found in no other career.

Sandra Millers Younger
Author, "The Fire Outside My Window: A Survivor Tells the True Story of California's Epic Cedar Fire"
May 20, 2014

Message from the Chief

Wildland Urban Interface Operating Principles is intended as a reference to provide readers with the tools necessary to better respond to, command, and understand incidents involving the wildland urban interface (WUI).

As you read this, please remember the changing landscape across the State presents challenges that cannot fully be addressed in this guide, or any guide. Application of these WUI principles is only one part of the equation -- the most critical component is engaging in meaningful dialogues and relationships with our State, federal, and local partners, and the citizens in the communities in California. Likewise, the principles in this guide should not be considered a substitute for thoughtful land-management and land-use planning, or for hands-on fireground training.

This guide is, however, an invaluable compendium that expertly captures each aspect of WUI firefighting. It reflects the current best-practices, both strategic and tactical. And while still an evolving field, I believe the principles reflected here can and will save homes and lives. Stay safe.

Chief Ken Pimlott

Wildland Urban Interface Operating Principles

WUI Operating Principles is the culmination of three years of research and organization spawned by the need for a stand alone guide addressing all aspects of firefighting in the wildland urban interface. Initially, a statewide cross section of CAL FIRE operations personnel from all levels met, and through a series of documented round table discussions, developed a foundational outline for the book. A smaller core group of individuals, including contract county representatives from Ventura and Los Angeles counties, met over the course of the next three years to develop the text, theories, concepts and innovations found in WUI Operating Principles, in essence, documenting countless cumulative years of WUI firefighting experience.

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Introduction

In the past, firefighters have gained knowledge of WUI firefighting by experience, often the result of trial and error. If fortunate enough to receive sage advice or counsel from an experienced mentor, the acquisition of WUI specific knowledge was accelerated. There were few if any full spectrum documents addressing all aspects of wildland urban interface firefighting.

WUI Operating Principles examines every aspect of wildland urban interface firefighting providing examples, easy to read graphs, and photos to illustrate, what up until now, was the personnel experience of well seasoned firefighters never before documented and organized into one volume. The term wildland urban interface is used generally throughout the document but is meant to include both wildland urban interface and wildland urban intermix conditions.

This book is about engaging and commanding a WUI incident and is intended for all elements of the operations section of the ICS organization, in particular engine company officers, strike team/task force leaders, division/group supervisors, branch directors, operations section chiefs, and most certainly incident commanders at all levels.

Some readers may be intimately familiar with the concepts found in several of the chapters, while others may be exposed to this information for the first time. Other books on WUI firefighting may address one or two of the subjects found in WUI Operating Principles however this document examines ten subject areas:

1. Leadership
2. Fire Behavior
3. Incident Command
4. Structure Triage
5. Strategy and Tactics
6. Resource Utilization
7. Cooperating Agencies
8. Evacuations
9. Planning
10. Safety

The chapters are specifically arranged to lead the reader through an organized progression of facts and concepts. The chapters are book-ended by leadership and safety, the foundations of successful incident command. Safety is the common theme throughout the document. It should not be misconstrued that because the Safety chapter is the last chapter, that safety has been de-emphasized in any way.

These chapters are linked by a common theme: On a WUI incident, the decision making process is not linear, it's circular. When applying past successful fire experience and training to a current situation, firefighters should imagine themselves as the hub of a wheel with decision options forming the circular rim of the wheel, allowing them to draw from any subject area or decision option as needed, in any random order, not when reached as one goes up or down a linear list.

All ten chapters are interrelated with an emphasis on safety and incident success. This document does not, however, have to be read chapter one through ten; each chapter stands alone. As you read, apply these concepts and innovations to your own past experiences to see how they would fit in. Apply these concepts and innovations to realistic training scenarios. And finally, apply these concepts and innovations to actual fire situations storing the outcomes in your mental slide tray for future use.

Notes from the WUI Working Group

WUI Operating Principles is a unique document that all firefighters will want to read and use for their own self improvement as well as for training at the station or administrative unit level. Its purpose is clear: it is a reference to establish CAL FIRE wildland urban interface operating policy and to provide the reader with the tools necessary to better command WUI incidents and dramatically reduce the risk of fatal WUI fires.

WUI Operating Principles simplifies and prioritizes incident command on WUI incidents by exposing common command problems and mistakes, and identifying various experience based solutions. To accomplish this, numerous bullet point lists will aid the reader in the complex decision making process of WUI incident command.

Recognizing current fire behavior and developing the critical skill of fire behavior forecasting is clarified with thoughtful examples of WUI specific fire behavior factors, how to recognize them and anticipate their influence on command decisions.

Safe structure triage is the cornerstone of survival in the WUI. With the introduction of the S – FACTS memory aid, company officers have a visual check list that addresses every aspect of structure triage from construction details, to equipment access, to the fire environment. The WUI Placard is also introduced as standardized visual documentation posted at the driveway of a residence by incident resources indicating whether or not a structure may be safely accessed and what conditions suppression resources will find at the structure when they arrive.

WUI Operating Principles does for the first time what no other WUI firefighting course or document has done: it addresses every aspect of WUI firefighting from leadership and command, to fire behavior and resource utilization, to strategy and tactics and more, all in one document. Numerous innovations and definitions developed and advocated in WUI Operating Principles have been adopted by FIRESCOPE and are now the standard for WUI firefighting throughout California.

Background Information

Wildland Urban Interface Operating Principles introduces new terminology that requires some background information in order to provide a clearer context as to their meaning..

Let's start with the change from the term structure protection to structure defense. The 2014 California Fire Management Agreement (also known as CFMA, CAL FIRE's agreement with federal wildland agencies, USFS, BLM, NPS, BIA and F&WS) defines the term structure defense as those actions taken to suppress a wildfire before it reaches structures. Structure defense is wildland firefighting and involves the use of standard wildland strategy and tactics. It also may include exterior activities to prepare the area for structure defense such as removal of wildland fuels around structures and using water enhancers and/or foam on surrounding vegetation and on the structures themselves. Structural firefighting occurs when structure defense has failed and the structure becomes involved in fire. The best form of structure defense is to suppress the wildland fire prior to structure ignition. Every effort should be taken to save property as long as these efforts DO NOT result in an undue safety risk for firefighters and the public we serve.

Firefighters are taught that when engaged in indirect attack and there is unburned fuel between the firefighter and the fire, escape routes and safety zones must be established. The definition of a safety zone is a preplanned area of sufficient size and location which is expected to protect personnel and equipment from the fire without using a fire shelter. The size of the safety zone is determined by the observed maximum flame height. The Incident Response Pocket Guide (IRPG) states the separation distance between firefighters and the flames should be a MINIMUM of four times the maximum continuous flame height. The IRPG states the use of Safety Zones does not apply in the WUI environment. Many times in the WUI Safety Zones do not exist as defined above. Housing density and small parcel size preclude the existence of large open areas and the ability to construct safety zones is often not practical without destroying residential improvements.

So how do we engage in structure defense actions when safety zones are often not available in the WUI? There are two options. One option is to not defend a structure(s). This may be the practical solution if conditions are such that the structure cannot be safely defended. However, there are times when a structure may be engaged in a safe manner even when a safety zone does not exist on site. The other option is to employ a Temporary Refuge Area or TRA. A TRA is a preplanned area where firefighters can immediately take refuge for temporary shelter and short-term relief without using a fire shelter although the area may not meet the definition of a safety zone (four times the flame height requirement) described above. Using a TRA however, will require another planned tactical action. This is because at some point the TRA may become compromised and the firefighter will need to utilize established escape routes to a safety zone or deploy a fire shelter if the conditions worsen. Other times firefighters may be able to re-engage the fire once conditions change for the better. TRA's are discussed in greater detail in Chapter 10 (Safety).

Many times in a fast moving WUI incident conditions change so fast that command and control communications break down or cannot be established. The term "Independent Action" was a term used in the past that allowed firefighters to make independent decisions without direction from the chain of command. "Independent Action" leads to freelancing and uncoordinated activities which may endanger firefighters and the public. "Appropriate Actions" are those actions taken based on leader's intent and the incident objectives. This allows individual units, task forces and strike teams to take actions before an opportunity is lost, in order to contribute to the suppression of the fire without receiving a direct order to take action from the chain of command. Appropriate Actions are discussed in greater detail in Chapter 1 (Leadership).

The WUI Placard is a new tool that gives firefighters safety information about a particular structure or group of structures that have been recently evaluated. This may help firefighters determine which structure(s) are safe to defend. Remember, the placard alone is not designed as the primary tool to determine whether or not a structure is safe to defend. That decision is based upon the conditions and fire behavior at the time of the fire's arrival.

In many instances there are not enough firefighting resources to defend all structures immediately threatened. Save the structures that are most easily defended first before putting effort in to those that will need further preparation to defend.

Strong leadership is required during a demanding WUI incident. Remember to "Base all actions on current and expected fire behavior."

While new terms are added to our WUI lexicon, many old adages still ring true. Preparation and pre-planning prior to an incident are still the keys to success. Knowing the response area, routes of travel, fire behavior and fire history will contribute to that success. Has the public been educated on what to do in the event of an evacuation? Prior to the incident, have relationships been developed between firefighters, law enforcement and other agencies that will respond?

Your advanced preparation will set the tone for success on the incident. Remember, fight fire aggressively, having provided for safety first.

Leader's Intent

Emergency operations in the wildland urban interface environment require continuous situational awareness based upon the fire environment, observed fire behavior, hazards and incident objectives. Firefighter and public safety is paramount and must be the number one tactical consideration when engaged in the defense of infrastructure and other valuable assets. It is understood that the defense of these assets shall not compromise firefighter and public safety and are initiated when safe and prudent to do so realizing the threat to life and property. Incident containment strategies must integrate perimeter control, fire suppression, and the defense of assets concurrently.

CAL FIRE Structure Defense Tactical Operating Principles

These principles are intended to guide CAL FIRE Incident Commanders who are charged with defending structures during wildland fire operations and compliment the "Wildland Urban Interface Operating Principles" developed by the California Wildfire Coordinating Group.

- The most effective form of structure defense is to suppress the wildland fire.
- The key to success in the Wildland Urban Interface is preparation and pre-incident planning.
- Perimeter control must be the number one operational priority utilizing established wildland firefighting tactics to suppress the fire before it reaches structures.
- Tactical resources should take "Appropriate Actions" based on "Leader's Intent" when communications break down.
- Operational resources assigned to defend structures not immediately threatened should be actively engaged in defense preparations. Sitting and waiting for the fire to arrive is not an option.
- Property owners have a responsibility to prepare their property for structure defense by providing adequate defensible space prior to the fire emergency (PRC 4291). These defendable structures should have priority when allocating resources.
- Type 3 engines are the best choice for wildland urban interface operations. However, any properly equipped engine can be an effective tool during structure defense operations.
- All resources assigned to structure defense operations must be staffed with adequately trained personnel and equipped with appropriate wildland firefighting equipment.
- Order the closest and deploy the most appropriate resources needed to integrate perimeter control and structure defense strategies, including engines, crews, dozers and air resources.
- Division Supervisors should supervise both perimeter control and structure defense operations within their geographic areas whenever possible.
- Structure Defense Groups should be assigned to geographic branches, operations or the IC as necessary, to coordinate structure defense assignments with the Division Supervisor and should

remain flexible and mobile to initiate perimeter control actions within the division if needed.

- The use of Structure Groups is appropriate when span of control and incident complexity dictates, not as the default choice. Use of Structure Branches should be minimized.

Chapter 1

LEADERSHIP

Strong and competent leadership is the foundation for success in any emergency situation. This is especially true during a rapidly developing wildland urban interface (WUI) incident. The fire service relies on competent leaders to motivate and direct firefighters during emergency incidents. Without solid leadership both firefighter and civilian lives are at risk.

FIRE SERVICE LEADERSHIP

Leadership is a dynamic state that requires education, experience, and self-examination. Leaders are not born; they are developed through experience, mentoring and training. Successful fire service leaders present a strong command presence while maintaining composure during very stressful circumstances. Leaders must know when to make tough decisions that will ensure firefighter safety. Leaders are responsible for the consequences of their decisions and accountable for the decisions and actions of their subordinates within the parameters of *leader's intent*.

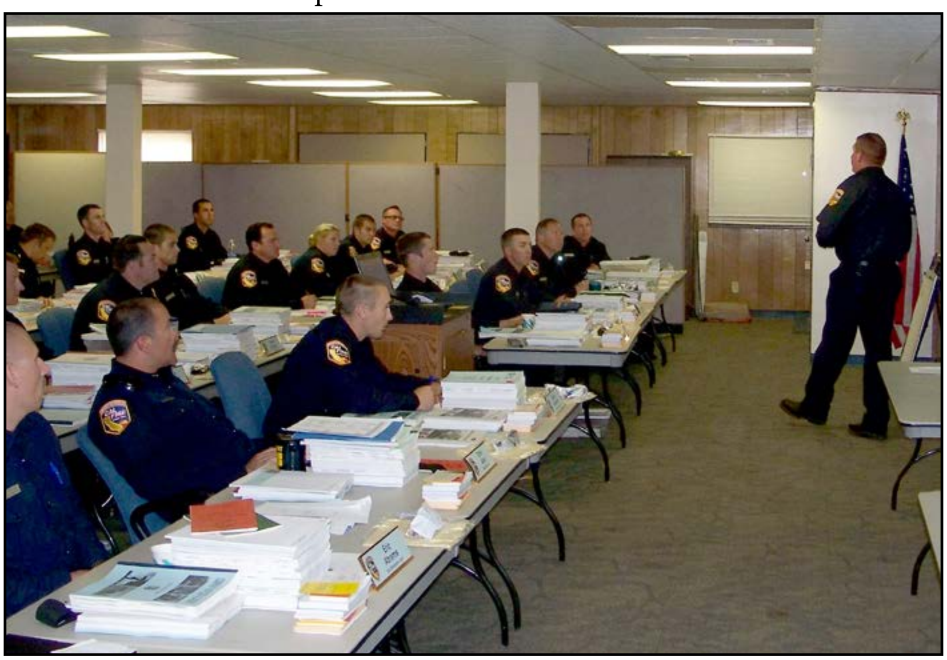


Figure 1.1. Training provides the theory and concepts that, when honed by experience, are essential for developing solid leadership skills.

Firefighters in the field want and need strong decisive leadership. Competent leaders recognize this and ensure that firefighters are *led from the front*. Ask any firefighter which leadership quality is most important on an incident,

Wildland Urban Interface
A condition where structures abut the wildland.

Usually identified as housing tracts or developments adjacent to a wildland area.

There is a greater potential for house-to-house ignition.

Wildland Urban Intermix
A situation where structures are scattered throughout a wildland area.

Leader's Intent
A clear, concise statement about the mission's overall tasks, purpose, and expected results.

Leading from the Front
Incident personnel know that the incident commander is definitely in charge of the incident; looking, listening and directing incident activities.

and the response will likely be "Leading by example". Successful leaders establish personal expectations before establishing and clearly communicating subordinate expectations. There can be no expectation of subordinate commitment without leadership commitment.

Leaders and subordinates must develop a relationship based on the ability to communicate the truth in a diplomatic manner. Simply put, leaders should not be afraid to solicit feedback from subordinates and subordinates should not be afraid to offer feedback to their leaders. Effective leaders lead by example with integrity and conviction, ever conscious of the fact that they are being constantly evaluated and assessed.

Fire service leaders assume the responsibility of placing their subordinates in dangerous situations. They must be willing to make decisions that profoundly affect citizens, communities, and values at risk. Occasionally, leaders are called upon to act in an authoritative, autocratic manner, making unpopular decisions that require immediate compliance. Great leaders inspire, motivate and support their subordinates, earning their respect and fostering a commitment to the task at hand.

LEADERSHIP GUIDELINES

Listen to those you work with. Remember that the further you are removed from the tasks on the ground, the more reality tends to pale and fade from your memory.
Empower subordinates and allow them to spread their wings.
Achieve your goals and help those that work for you achieve theirs.
Demonstrate by being a role model. Lead by example. Show them how it's done.
Encourage others to achieve and reach for a higher standard.
Respond to the needs of peers, subordinates, and the organization.
Share knowledge.
Help others meet their expectations.
Inspire to lead and others will follow.
Prepare peers and subordinates to succeed.

- Don Studebaker
United States Forest Service

VALUES AND PRINCIPLES

Fire service leadership incorporates the values of duty, respect, integrity and leadership.

Duty

An adherence to duty includes being proficient in the profession, technically and as a leader; making sound and timely decisions; ensuring that tasks are understood, supervised, and accomplished; and developing subordinates for future leadership roles.

Proficient leaders take charge when they are in charge and adhere to professional guidelines. They are also skilled in developing plans to accomplish given objectives.

When leaders make decisions they must maintain *situational awareness* in order to anticipate needed actions and develop contingencies while considering the consequences of each. Sometimes they must improvise within the leader's intent to handle a rapidly changing environment.

Situational Awareness
The ability to identify, process, and comprehend the critical elements of information about what is happening with regards to the mission, allowing organizations and individuals to anticipate requirements and to react effectively and safely.

Respect

Leaders demonstrate respect by knowing their subordinates and looking out for their well being. This means putting the safety of subordinates above all other objectives, taking care of subordinate needs before their own, and helping resolve any conflict between individuals on the team. Leaders also keep their subordinates informed, providing accurate and timely briefings and explain the intent behind tasks and assignments. Being available to answer questions at the appropriate time is critical to demonstrating to the team its value.

Figure 1.2. Caring for subordinates needs, mediating and solving conflicts, and informing subordinates of incident objectives, hazards and leader's intent through complete and accurate briefings is the foundation for mutual respect. Photo courtesy of Kari Greer.

Building a strong and successful team is very important to incident success and good leaders employ subordinates in accordance with their capabilities.

Integrity

Integrity focuses on the leader's qualities and capabilities. Strong leaders know their strengths and weaknesses and constantly strive to improve. They seek responsibility and accept responsibility for their actions. Above all, they set an example for their subordinates, and for the civilians and community they serve and protect.

LEVELS OF LEADERSHIP

Generally, the role and focus of a leader depends on the level in which he or she works. Most organizations have four levels of leadership. Although the basic principles of leadership are the same at each level, their practical application varies depending upon where in the organization a leader operates. It is not uncommon for a leader to work on more than one level at the same time.

COMMAND PRESENCE

Command presence is one of the most important components of effective and successful incident command. Command presence can have a positive or negative influence on the entire incident organization. Without strong

Command Presence
The bearing or demeanor of the person in charge.

WILDLAND FIRE LEADERSHIP VALUES AND PRINCIPLES	
Values	**Principles**
Duty	**Be proficient in your job, both technically and as a leader.** • Take charge when in charge. • Adhere to professional guidelines. • Develop a plan to accomplish given objectives. **Make sound and timely decisions.** • Maintain situational awareness in order to anticipate needed actions. • Develop contingencies and consider consequences. • Improvise within the leader's intent to handle a rapidly changing environment. **Ensure tasks are understood, supervised, and accomplished.** **Develop subordinates for the future.**
Respect	**Know subordinates and look out for their well-being.** • Put the safety of subordinates above all other objectives. • Take care of subordinates' needs before your own. • Resolve conflicts between individuals on the team. **Keep subordinates informed.** • Provide accurate and timely briefings. • Give the reason (intent) for assignments and tasks. • Be available to answer questions at appropriate times. **Build the team.** **Employ subordinates in accordance with their capabilities.**
Integrity	**Know yourself and seek improvement.** **Seek responsibility and accept responsibility for your actions.** **Set the example.**

command presence, suppression personnel will lack the confidence in leadership critical for incident success. Strong command presence sets the tone for the incident and instills a sense of security and competency that spreads throughout all levels of the incident organization. Great leaders look, act, and speak with authority and confidence. They project a calm, organized, and focused image.

Command presence is part of daily life. Every day, subordinates gauge the demeanor of their command officers both on and off incidents. The way leaders carry themselves each day translates into their demeanor on an incident. Command presence is infectious; once confidence in leadership is established, subordinates will strive for excellence.

Command presence should not be confused with an officious, authoritative attitude: "I am the chief, therefore I am in charge". Leaders with poor attitudes neither instill confidence nor garner respect.

Some of the elements of strong command presence include:

- **Dress and grooming**: Clean and compliant uniform, well groomed, and appropriate personal protective equipment
- **Speech:** Speak with knowledge and confidence
- **Bearing:** Head high with good posture, physically fit
- **Communication:** Communicate with knowledge and confidence, giving clear, concise direction
- **Respect:** Respect cannot be demanded, it is earned when subordinates are inspired and motivated to excellence

THE FOUR LEVELS OF LEADERSHIP			
Level	**Description**	**Fire Service Examples**	**ICS Examples**
Leaders of Organizations	Leaders who are primarily concerned with providing the vision, direction, and resources to guide the organization into the future.	Agency Administrators Fire Chiefs Department Directors	Incident Commanders
Leaders of Leaders	Leaders at this level exercise direct leadership over subordinate leaders and indirect leadership over the organization below them.	Deputy Chiefs Assistant Chiefs Division Chiefs	Command and General Staff
Leaders of People	Leaders at this level exercise the direct, face-to-face supervisory skills required to accomplish tasks and facilitate team building.	Battalion Chiefs Fire Captains Company Officers	Unit leaders Division / Group Supervisors
Followers	As a team member, a future leader develops a foundation of values, character, and proficiency. Effective leadership requires being a good follower. For this reason, leaders must strive to build good "followership" skills in their team members.	Firefighters	Support Personnel Single Resources Strike Teams Taskforces

Several factors increase the challenges in all high-risk environments, creating barriers to effective leadership and positive command presence:

- **Time pressure:** The feeling that something must be done now or that progress is taking too long
- **High stakes:** Political pressure, high profile incident, risky situations
- **Incomplete and/or inadequate information:** Poor intelligence from field personnel, unfamiliar with the area
- **Ambiguous objectives:** No clear mission, uncertainty about leader's intent
- **Poor strategy and tactics:** Continuing to engage in the initial attack mode when the fire is obviously in the extended attack mode
- **Rapidly changing conditions:** Overwhelmed by the complexity and tempo of the incident
- **Coordination:** All elements of the organization aren't working together

A lack of command presence, coupled with the failure to make decisions, may contribute to command collapse. When field personnel lose confidence in the person in charge, the overall incident command is jeopardized.

Indicators of command collapse may include:

- Failure to answer the radio by the incident commander (IC)/command officers
- Lack of, or no direction from the incident command post (ICP)/IC
- "Deer in the headlights" syndrome
- Failure to respond to changing conditions
- Tailboard syndrome (focusing on small tasks, but ignoring the big picture)
- Doing nothing, failure to make decisions
- Failure to adjust a plan that is not working
- Not monitoring and/or adjusting objectives

Without competent leadership and strong command presence, company officers and firefighters tend to "Do something, anything," which may or may not be coordinated or in support of leader's intent or incident objectives. This is commonly referred to as independent action, or freelancing, which is unsafe and may be detrimental to firefighter safety and the control effort.

Examples of freelancing may include:
- Unauthorized or uncoordinated firing operations
- Futile hose lays, hand lines, or retardant lines
- Uncoordinated hand line or dozer line construction
- Independent resource ordering

Thirtymile Fire (Chewuch River Canyon, Washington) - July 2001

On July 10, 2001, four Forest Service fire suppression personnel were killed after they became entrapped and their fire shelter deployment site was burned over.

Excerpt from the Thirtymile Factual Report regarding personalities and safety attitudes:

Contrasting personality traits: Crewmember testimony indicates that the IC was not a forceful leader and that may have impeded his ability to command the situation at the deployment site, especially when contrasted with the personality traits of the crew boss trainee and some of the squad bosses on site, who were described as more charismatic and outgoing.

SITUATIONAL AWARENESS

Situational awareness is the ability to identify, process, and comprehend the critical elements of information about what is happening with regards to the mission, allowing organizations and individuals to anticipate requirements and to react effectively and safely. More simply, it is recognizing and reacting to what is going on around you.

On incidents, situational awareness involves knowing: objectives, communication paths, command structure, previous and current fire behavior, weather, local factors, deployed and available resources, and evacuation needs. Situational awareness is a continuous cycle through four interrelated and overlapping processes:
- Observation: collecting data
- Orientation: analyzing and organizing data
- Decision: determining a course of action based on the data
- Action: the physical playing-out of decisions

Throughout this process, the situation may be changing. Sometimes leaders will need to cancel or change a planned action in order to meet the changes. The more quickly a leader can orient to an incident, the more successful future actions will be.

LEADER'S INTENT

Successful operations are built on the ability of leaders to define and communicate their intent so that it empowers their subordinates to exercise their initiative. Everyone, from a section chief down to every last firefighter, must understand their leader's intent.

Leader's intent is a clear, concise statement that outlines what individuals must know in order to successfully achieve the mission's task, purpose, and expected results. The intent communicates three essential pieces of information:

- **Task:** The objective or goal of the assignment
- **Purpose:** Why the assignment needs to be done
- **End state:** How the situation should look when the assignment is successfully completed

At the incident level, the end state places the values at risk within the context of the standing incident priorities: life, property, natural resources, and management goals and concerns for the affected area. Within the framework of a defined end state, leaders can develop plans that include incident objectives, priorities, strategies, decision points, and contingency plans.

Leader's intent enables subordinate leaders closest to the scene of action to adapt current incident plans to current incident situations taking *appropriate action* to accomplish the incident's objectives when unanticipated opportunities arise. This gives subordinate groups the freedom to adjust to ever-changing incident situations.

Appropriate Action
The action necessary under the incident objectives when situations change or communication with command and control functions cannot be established.

Within a given incident, there will be one leader's intent but there may be multiple subordinate leaders' intent statements that measure their actions against, and fall under the umbrella of, the over reaching leader's intent.

At the geographic division level, division supervisors focus on the incident objectives affecting their division, using the same process to define task, purpose, and end state. At the crew level, leaders focus on tactical objectives and vary those tactics as the situation dictates. Leaders narrow their focus at each level, identifying the objectives that apply to that level.

The leader's intent statement from the Incident Commander (IC), is to defend life and property and conduct perimeter control actions on all areas of the incident when safe to do so. This is a fairly general state-

Figure 1.3. Incident Management Teams listen to the IC's leader's intent in order to execute the Incident Action Plan.

ment allowing subordinate leaders to act on their own within the purview of the IC's intent statement, in essence, forming their own subordinate leader's intent statement. In this case, an engine strike team leader can position five engines around threatened structures directing them to defend the structures when safe to do so using the structure triage process and to also take advantage of any opportunity to extinguish sections of the fire perimeter. The strike team leader will decide on the appropriate tactics for the situation and may change the tactics as conditions change.

WUI incidents inevitably create conditions in which centralized command and control of all actions and events cannot keep pace with incident complexity. In fast-moving, dynamic situations, top-level decision makers cannot always incorporate new information into a formal planning process and redirect personnel within a reasonable time frame.

In other words, when things go wrong, plans become less useful and centralized management may not be able to keep pace with the real-time situation on the ground. In these situations, leader's intent has the ability to counter the potential ineffectiveness of centralized command. Competent subordinate leaders at the incident may understand the current situation better than incident command located some distance from the scene. However, subordinate actions cannot be independent or uncoordinated, they must align with the leader's intent.

APPROPRIATE ACTION

On a chaotic and rapidly developing incident, exercising appropriate action can make all the difference. Appropriate action is action necessary under the incident objectives when situations change or communication with command and control functions cannot be established.

Appropriate action results from a firefighter's perception of leader's intent based on incident objectives, normal policies, procedures, or accepted safety practices. Being hesitant, risk-averse, or indecisive can expose firefighters to greater long-term risks and waste time, opportunities, energy, and money.

During an incident, one person may see something that must be done now, and take appropriate action to complete that task within the scope of leader's intent. Time may not permit obtaining permission, communicating the problem and mitigation options, or informing the chain of command of an action before the opportunity is lost.

In these time-critical situations, subordinate leaders must engage in appropriate action, that is, act within the leader's intent statement by:

- Utilizing acceptable and prudent suppression tactics
- Working in coordination with adjoining forces
- Developing and communicating an appropriate plan
- Informing the chain of command of the situation and mitigation actions as soon as possible
- Ensuring that their actions are within policy, procedure, and accepted safety norms

Examples

1. An engine company driving through another division to get water comes upon a spot fire. Based on the leader's intent of perimeter control, the engine company supervisor should take

appropriate action and contain the spot fire.

2. A fire crew is conducting a planned firing operation. While doing the test burn they encounter spotting and holding problems due to a lack of holding resources. Realizing that continuing the firing operation would be risky, and unable to contact the division supervisor, the crew supervisor suspends the firing operation.

3. While engaged in structure defense tactics with an engine company, the fire front intensity subsides. The engine company officer changes to perimeter control tactics, initiating a progressive hose lay based on leader's intent of perimeter control and fire containment.

4. While assigned to a division, an engine strike team constructing a hose lay observes the fire changing direction immediately threatening an area of homes that are inhabited and defensible. Unable to contact the division supervisor, the strike team leader repositions the engines for structure defense tactics and initiates evacuations, coordinating with law enforcement in the area.

COMMUNICATION

Leaders don't simply tell subordinates what to do, or describe the end state of an assignment. If necessary, leaders must be prepared to paint a picture of the entire fire situation to inexperienced suppression resources that may be confused about an assignment or reluctant to engage.

Sometimes a tactical option selected by a leader may conflict with a firefighter's perception of what is safe or tactically prudent. Leaders must realize that not all suppression personnel have the same level of experience. Some may feel uneasy in certain fire behavior situations, especially when asked to perform an unfamiliar tactical option or confronted with extreme fire behavior. A large part of leadership is clarifying a tactic and its relationship to current fire behavior.

Figure 1.4. The importance of a complete and well organized briefing to ensure that all suppression resources understand the incident objectives, strategies, and tactics cannot be over emphasized .

The best way for leaders to ensure that all suppression resources understand the incident objectives, strategies, and tactics is to carry out a complete briefing for all incident personnel. This is particularly important when new resources arrive at an incident and receive their initial assignment or when resources move from one area of an incident to another.

DECISION MAKING

Leaders are required to make sound, timely, sometimes unpopular decisions, often under stressful circumstances. Even a good decision can have negative ramifications.

Scenario	Good Decision	Negative Ramification
Extreme fire behavior poses undue risk to firefighters	Fire line supervisor orders resources out of harm's way	Structures and other values may be destroyed

Even when a leader makes a good decision for the right reasons, firefighters and the public may struggle with what they believe are unacceptable consequences. Leaders cannot take decisions of this nature personally. Good leaders are confident in their abilities and make decisions based on all available current intelligence. They must not become mired in the collateral consequences of their decisions.

Training and Experience

When it comes to making decisions in time-sensitive or high-stress situations, inexperienced leaders tend to rely on their training while experienced leaders tend to recall past experiences and apply past successful actions to their current situation. This is referred to as the Risk Management Process in the Incident Response Pocket Guide.

This process is generally subconscious and is comprised of five critical steps:
1. Situational awareness
2. Situational recognition
3. Analysis and selecting a course of action
4. Decision point
5. Action

Also known as "slide tray" or recognition-primed decision making (RPD), this process helps leaders make quick effective decisions when faced with complex and dynamic situations.

Feedback and Input

Competent planning requires honest and timely feedback from numerous sources. Because fire line leadership often places line supervisors and ICs some distance from the scene of action, it can be difficult for them to actually observe the resources they supervise. Therefore, feedback and input from the field is a critical component of the leader's decision-making process.

Leaders cannot dismiss feedback and input from the field and should filter all information as they receive it in order to make sound decisions. If leaders do not solicit or do not accept intelligence or feedback from the field, even the most well-thought-out plans are likely to fail.

Figure 1.5 Leaders should accept, evaluate and appropriately use input from their subordinates who often have a different, and sometimes better perspective of the same situation. Photo courtesy of Kari Greer.

Feedback from fire line leadership back to the field personnel is equally as important. Two-way communication ensures ongoing feedback about the situation, progress, needs, and safety concerns.

TEAM BUILDING AND CREW COHESION

Teamwork is an essential leadership component and team building starts long before any incident activity.

Team building has three phases: formation, development, and sustainment. All teams, whether they are long-standing or short-lived, go through these predictable phases. Leaders who recognize team members' progress can better facilitate this process enabling a team to mature quickly, achieving greater synergy and cohesion.

Figure 1.6. Incident management teams rely on group cohesion to maintain their professional edge. The team building process is repeated each time new members join the team. The team IC must understand and accelerate the three phases of the team building process for a seamless assimilation.

The Formation Phase

The formation phase begins when a group of strangers come together with the expectation that they will function as a team. This phase is characterized by a lack of information: team members do not know each, their leader, or what to expect. Roles and responsibilities may be undefined. Standard policies and operating procedures may be unclear. Communication norms and acceptable methods of dealing with conflict may not be spelled out. Anxiety about the unknown is high. For the most part, people are simply trying to make sense of their environment and the new people in it.

It is important to recognize that when a new person or group of people joins a team, they are in the formation phase regardless of the stage of development of the rest of the team. Newcomers may significantly impact team cohesion unless they quickly transition through the formation phase.

The leader's primary responsibility during the formation phase is to turn the unknown into the known as quickly as possible, thereby reducing the level of anxiety within the team through effective communication.

The Development Phase

The development phase begins when team members' concerns and anxieties have been reduced or eliminated. This phase is characterized by individual initiative, meaningful feedback, and conflict resolution. Team members are ready, willing, and able to get to work. Information moves through the team quickly and efficiently.

Figure 1.7. Leaders often work with individuals they do not know or know well during stressful situations, creating an uneasy relationship that must be overcome in order to successfully complete the task at hand.

Team members may not yet feel a collective ownership of the team's effort during the development phase and may often waver between individual and team identity. As a result, conflicts may erupt as individuals try to better define roles and responsibilities, jostle for position, and bump into each other while trying to achieve their perception of the common goal.

In the development phase, teams begin to test what was communicated to them in the formation phase. They measure word against action and the more closely they match, the greater the trust. During the development phase, the leader should focus on providing the mechanisms and environment to develop trust. As a first step, maintain consistency and enforce agreed-upon policies, follow standards, reinforce intent, and practice open communication. Leaders should demonstrate trust in the group's outputs and products.

The Sustainment Phase

The sustainment phase begins when team members' sense of identity shifts from individuals to the team. It is characterized by creativity, adaptability, and precision. The team has become highly focused and effective. The communication and trust built in the previous phases is focused and brought to bear on the team's mission with precision. Team members demonstrate a willingness to support each other in achieving a common goal. They know how to back each other up and are willing to address the task at hand. Errors and problems are detected early, and when found, the team corrects them quickly.

They see themselves as part of something larger than themselves. They are now functioning as a team, not as individuals. Understanding about the team, team members, the leaders, and the mission is high. The team, rather than the individual, accomplishes tasks.

A leader's biggest challenge during the sustainment phase is to avoid complacency and persistently find ways to improve the process. A cohesive team does not stay that way by itself, so to prevent the team from losing ground, it must continuously improve. Ensure that the groundwork established in the formation and development phases remains intact. Communication, trust, and respect must be maintained to sustain a cohesive team.

Figure 1.8. Whether a small engine crew or a large Type 1 crew, leaders must understand that cohesion keeps the crew in tact, increasing the quality and quantity of performance, while maintaining the safety edge. Photo courtesy of Kari Greer.

Crew Cohesion

Whether it is a fire crew, a work team, committee, or basketball team, to be effective team members must work together. In the case of a fire crew, crew safety is just as important as effectiveness.

The ability of fire crew members to effectively work together has an impact on their ability to communicate with each other as well as with other crews. Crew cohesion affects the quality of decision making, conflict resolution, and trust. Near miss and fatality investigations show a connection between lack of crew cohesion and fireline fatalities.

Common crew cohesion problems include:
- Individuals not getting along
- Working with unfamiliar resources
- Intensifying fire behavior increasing stress levels
- Distrust between crew members
- Communication breakdown
- Questionable tactics
- Lack of local knowledge
- Loyalties and cliques
- Failed expectations

It is imperative that leaders develop strong crew cohesion prior to incidents to reduce the potential for these types of problems.

This cohesion should not only occur internally amongst agencies and crews, but also externally with other agencies. Interagency team building ensures that all personnel will better understand each other's strengths and weaknesses and are more apt to support one another.

CAREER DEVELOPMENT

As firefighters progress through their careers, they should continue to learn. Rising through the ranks, it is easy to fall into the trap of becoming disconnected from the field. All leaders need to stay apprised of current trends, needs, training methods, and procedures.

Consider pursuing the following resources for continuing education and professional leadership development:
- Formal and informal training
- Sand tables and simulators
- Case studies and staff rides on past incidents
- Listening and talking to other fire service members
- Mentor/mentee relationships
- Books and articles on leadership
- Internet resources

All personnel regardless of rank or position must strive for improvement throughout their careers. A good leader seeks to stay informed, trained, and experienced to meet the ever-changing demands of the fire service.

Figure 1.9. Leaders who strive for excellence should be open to advanced training opportunities such as the Incident Management 3 class.

CHAPTER

2

FIRE BEHAVIOR

Every command officer should possess the ability to accurately forecast fire behavior. Strategies and tactics fail when officers fail to forecast or incorrectly forecast fire behavior, or cannot explain the factors that influence fire behavior. Basing all actions on current and forecasted fire behavior helps command officers make strategic decisions, implement effective tactics, and effectively order resources.

FUEL, WEATHER, AND TOPOGRAPHY

The fire environment includes the materials fueling the fire, weather, and topography that influence its rate and direction of spread. Command officers should use every available tool to generate fire behavior forecasts including fire history, current and forecasted weather, and local geography.

Fuel

Fuel, like weather, is an ever-changing variable in the fire environment and must be addressed in any fire behavior forecast. Fuel type, loading, horizontal continuity, vertical arrangement, size and shape, moisture content, chemical content, fuel bed depth and live fuel to dead fuel ratio, have a profound effect on fire behavior. Fire fighters should be cognizant of the fuel characteristics influencing current fire behavior. Additionally, fuel characteristics ahead of the fire front and in the direction of spread, must be known in order to make viable fire behavior forecasts.

Figure 2.1. Mobile attack in a grass model fuel bed.

Types

Figure 2.2 Heavy fuel loading in a brush model.

The primary fuel types are grass, grass/shrub, shrub, timber litter, timber understory, and slash/blow down. A fuel type description should describe conditions at the head of the fire, or the fire front. Use the predominant fuel carrying the fire to develop the fire behavior forecast.

Incorporate fuel types ahead of the fire into the planning process for resource needs and problem areas that may require attention.

Loading

Fuel loading is defined as the oven dry weight of fuels in a given area usually expressed in tons per acre. Natural fuel loadings vary greatly by vegetative or fuel types. Grassland areas may produce fuel loadings of 1 to 5 tons per acre. Brush species such as chaparral, may produce 20 to 40 tons per acre; logging slash, 30 to 200 tons per acre; and timber, 100 to 600 tons per acre. These are all typical ranges but will not fit every fuels complex. Firefighters have to estimate how much fuel is present in a given area. Sparse, thin fuel beds may not support extreme fire behavior or rapid rates of spread. Conversely, heavy fuel beds of any type may support rapid rates of spread and extreme fire behavior.

Continuity

Fuel continuity is an important factor in fire behavior. Continuity refers to the horizontal arrangement of the fuel, whether the fuel is closely or sparsely spaced. This characteristic influences where a fire will spread, how fast it will spread, and whether the fire travels through surface fuels, aerial fuels, or both. Horizontal continuity is the extent of horizontal distribution of fuels at various levels or planes.

Figure 2.3. Ground fire and torching in a timber fuel model.

Firefighters should consider the following:

- Are the fuels carrying the fire continuous or are they separated by areas of sparse fuel or gaps in the fuel bed?
- Are timber crowns continuous and intertwined or spread out?

A forest canopy not only shades surface fuels and prolongs moisture retention but also greatly reduces wind speeds from levels above the canopy to levels near the surface. Generally, the greater the crown closure, the greater the wind speed reduction. This certainly does have an effect on surface fires burning in these closed environments.

- Are numerous ladder fuels present? Ladders fuels are a fuel bed that starts on the ground and ends in the crowns of trees or large brush species, where fire can be carried up into the aerial fuels.

Vertical Arrangement

The relative heights of fuels above the ground, and their vertical continuity, influences fire reaching various fuel levels. In some mature timber situations, there are several levels of fuels which may help transport fire from the surface to the crowns. Surface fuels mostly consist of grass and litter of various sizes. Low fuels may consist of shrubs, low limbs, and small young trees. A sub-canopy might consist of understory trees and larger regeneration. The canopy is made up of mature tree crowns perhaps over 100 feet tall. Fire may burn through one or more levels without burning the canopy regardless of the maximum height of the fuels and the number of fuel levels involved. When fuels are mostly vertically continuous, a fuel ladder exists to transport fire into the forest canopy.

Shape and Size

Smaller fuels ignite and sustain combustion easier than large blocks of fuel because less heat is required to ignite the smaller fuel particles. Fuel shape is a significant factor in the problem of spotting. Some fuels are likely candidates as aerial firebrands and have traveled distances of 10 miles or more downwind from a large, dynamic vegetation fire. The fuel's flatness and greater surface-area-to-volume ratios have increased their aerodynamic qualities, thus making it easier for convection columns to lift them to greater altitudes. Fuel shape is also important to spotting down slope by rolling fire-brands. Pine cones, round logs, and round yucca plants are particularly troublesome in their respective areas.

Moisture

Fuel moisture is an expression of the amount of water in a fuel component and determines the amount of heat required to bring the fuel to its ignition temperature. The moisture content of fine fuels is of primary importance when considering fire spread.

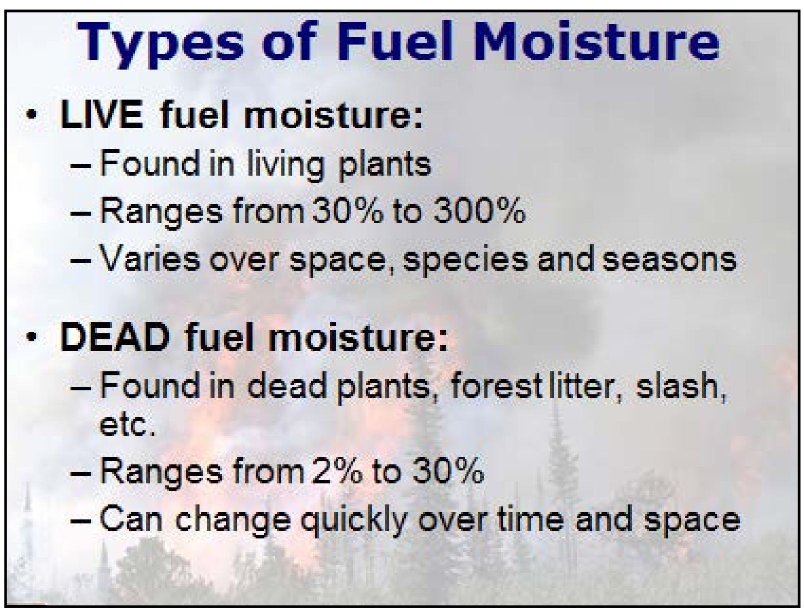


Figure 2.4. Live fuel and dead fuel moisture are both contributing factors to the fuel characteristics in the WUI.

Dead fuels are prone to absorb or release moisture from the air responding to day-to-day and hourly changes in the relative humidity surrounding the fuel. Live fuel moisture is related to the amount of soil moisture present. Live fuel moisture is a result of physiological changes in the plant due mainly to the time of year, precipitation events, temperature trends, and the species of the plant.

Firefighters should pay close attention to the periodic fuel moisture sampling measurements in order to gauge potential fire behavior.

Chemical Content

Certain forest fuels contain high amounts of volatile substances that can contribute to rapid rates of spread and extreme fire intensities. The chemical properties of forest fuels include the presence of volatile substances such as oils, resins, wax, and pitch which accelerate rate of combustion. Other fuels may be high in mineral content, which can reduce fire spread and intensity.

Fuel Bed Depth

Obviously, the depth of the fuel bed will have a significant affect on fire behavior. A shallow fuel bed means less fuel to burn resulting in less heat produced by the fire. Conversely, a deep fuel bed provides more fuel for a more intense burn and also extends the fuel source higher into the vertical fuel environment.

Live Fuel to Dead Fuel Ratio

Live to dead fuel ratios are important factors when forecasting fire behavior. Firefighters must estimate the percentage of dead fuel present in a fuel bed and determine how that percentage will affect fire behavior. Dead fuels ignite more readily and contribute to increased fire spread. A prevalence of dead fuel in the fuel bed will increase fire intensity and compound suppression difficulties.

Ornamental Vegetation

Ornamental vegetation found in the WUI contributes to overall fire behavior. Home owners enjoy having a nicely landscaped yard however, many do not take the flammability of ornamental vegetation into consideration when selecting and positioning their shrubs and trees. Firefighters defending a structure should evaluate ornamental vegetation along with the native vegetation when assessing threat potential and evaluating vegetation clearance adequacy.

Figure 2.5. Ornamental vegetation must be considered when evaluating a structure for defense.

DESCRIPTION OF FUEL MODELS USED IN FIRE BEHAVIOR as Documented by Albini (1976)						
			FUEL LOADING			
Fuel Model	**Typical Fuel Complex**	**1 hour**	**10 hours**	**100 hours**	**Live**	**Fuel Bed Depth**
		-------------Tons/Acre-------------				**Feet**
	Grass and grass-dominated					
1	Short grass (1 foot)	0.74	0.00	0.00	0.00	1.0
2	Timber (grass and understory)	2.00	1.00	0.50	0.50	1.0
3	Tall grass (2.5 feet)	3.01	0.00	0.00	0.00	2.5
	Chaparral and shrub fields					
4	Chaparral (6 feet)	5.01	4.01	2.00	5.01	6.0
5	Brush (2 feet)	1.00	50.00	0.00	2.00	2.0
6	Dormant brush, hard-wood slash	1.50	2.50	2.00	0.00	2.5
7	Southern rough	1.13	1.87	1.50	0.37	2.5
	Timber litter					
8	Closed timber litter	1.50	1.00	2.50	0.00	0.2
9	Hardwood litter	2.92	41.00	0.15	0.00	0.2
10	Timber (litter and understory)	3.01	2.00	5.01	2.00	1.0
	Slash					
11	Light logging slash	1.50	4.51	5.51	0.00	1.0
12	Medium logging slash	4.01	14.03	16.53	0.00	2.3
13	Heavy logging slash	7.01	23.04	28.05	0.00	3.0

Weather

> **Weather**
> The state of the atmosphere surrounding the earth.

Weather is the state of the atmosphere surrounding the earth. Weather, in particular wind, temperature, relative humidity, and atmospheric stability, exerts the greatest influence on fire behavior; primarily the rate and direction of fire spread. Before an alarm ever sounds, firefighters should ask themselves, "How will today's weather conditions affect today's fire behavior?"

Figure 2.6. Rapidly expanding wind driven WUI fire.

All firefighters should know what weather conditions will prevail for the next 48 to 72 hours in their initial attack area and how those conditions will affect fire behavior. Command officers should become students of weather by learning to read surface maps, satellite images, and cloud types and the weather conditions they indicate. Command officers should always anticipate a change in the weather and should require hourly weather observations from multiple incident locations.

Command officers should utilize the services of the National Weather Service and request spot weather forecasts when situations are critical. The request process can be online or by phone or fax to the appropriate National Weather Service Forecast Office covering the affected area. Turn-around time can be 15-30 minutes for a geographically detailed forecast that will cover the next 12-24 hours.

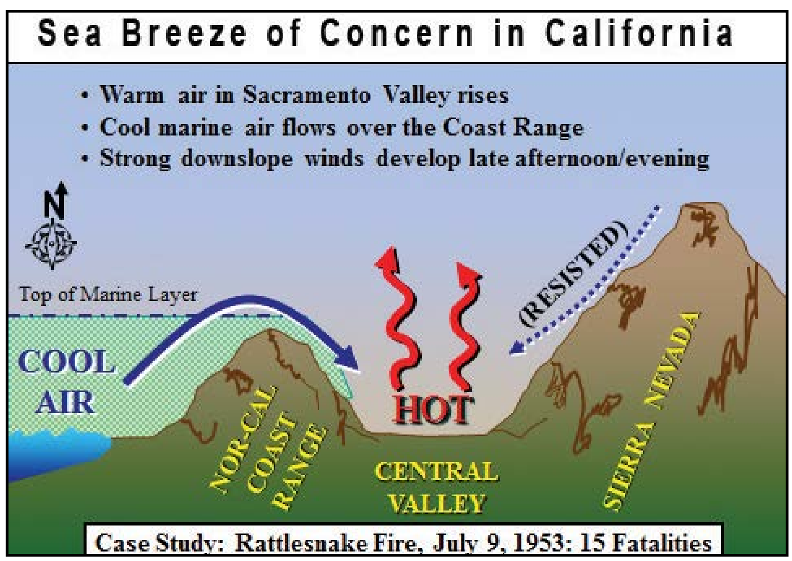


Figure 2.7. As temperatures increase and warm air rises in the Central Valley of California, the coastal marine layer deepens until it literally spills over the coast range and rushes toward the valley floor creating significant adverse wind conditions for firefighters. This same condition exists along the valleys and mountains of the central California coast and in the valleys and coastal mountains of Southern California.

Wind

Wind is the result of uneven heating and cooling of the earth's surface and the difference between pressure gradients throughout the atmosphere. Wind has a profound impact on fire behavior influencing both the rate and direction of spread. Wind also dissipates and carries away moisture-laden air and hastens the drying of fuels, especially light, flashy fuels. Wind aids in the creation of spot fires by depositing embers, sometimes great distances, in front of the main fire. Wind has a tendency to bend flames closer to the ground, preheating the unburned fuels in front of the fire.

Burnover
An event in which a fire moves through a location and overtakes personnel or equipment where there is no opportunity to utilize escape routes and safety zones, often resulting in personal injury, death, or equipment damage.

Of all the elements that make up the fire environment, wind is the most variable and unpredictable. Failure to anticipate and prepare for shifting winds has resulted in injuries, *burnovers*, and fatalities.

Winds are strongly influenced by topographical features and the local heating and cooling of the earth's surface. When wind aligns with topographical features such as large drainages, canyons, or chimneys, firefighters should expect accelerated wind speeds and erratic fire conditions in and around these topographic features.

Figure 2.8. Wind speed can be estimated with reasonable accuracy or measured with greater accuracy by using a digital hand held weather device such as the Kestral. Photo taken by Robert Eplett / CA OES

Wind Speed and Direction

There are several ways to measure wind direction and wind speed. Wind direction is stated as the cardinal compass direction from which the wind originates. If the wind is blowing from north to south it is described as a north wind. If the wind is blowing from west to east it is described as a west wind and so on. Firefighters should carry a standard compass or some other directional device with them in the event they find themselves in unfamiliar territory or are engaged in night suppression activity and cannot remain oriented to the cardinal compass points.

Wind speed can be established by estimate or by using an anemometer. Estimating wind speed improves with experience and is aided by using the Beaufort Wind Force Scale as a guide. The Beaufort scale is a practical measure that relates wind speed to observed conditions at sea or on land, it is a measure of wind speed and not of "force" in the scientific sense of the word.

Firefighters should study the Beaufort scale and learn to estimate wind speed based on what they observe in the wildland setting. Estimates should be confirmed by using an anemometer to ensure accurate readings.

Anemometers come in all shapes and sizes and are available in many outdoor sports stores. Ranging from the simple hand held variety found in belt fire weather kits to sophisticated Kestrel multi function units, any anemometer a firefighter chooses to carry will greatly increase the odds of an accurate fire behavior forecast or rate of spread prediction.

BEAUFORT WIND SCALE			
Force	**Wind (Knots)**	**WMO Classification**	**Appearance of Wind Effect On the Land**
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Twigs breaking off trees, generally impedes progress
9	41-47	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Seldom experienced on land, trees broken or uprooted, “considerable structural damage”
11	56-63	Violent Storm	
12	64+	Hurricane	

General Winds

General winds are produced by broad-scale pressure gradients but may be modified by local topography or surface friction. General winds vary in speed and direction as high and low pressure areas develop, move, and decay.

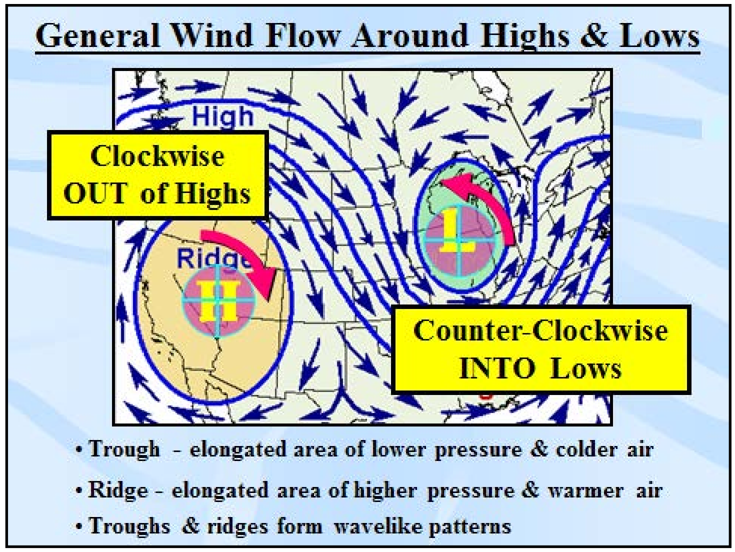


Figure 2.9. General winds produce the daily large scale fluctuations in wind speed and direction based on the position of high and low pressure areas.

Mechanical and Thermal Turbulence

The degree of wind speed reduction or direction change depends on the roughness of the earth's surface. Surface winds vary considerably in both direction and speed over short intervals of time and tend to blow in a series of gusts and lulls.

Mechanical turbulence is caused by surface friction while thermal turbulence is associated with instability and convective activity, usually more pronounced in the early afternoon. With thermal turbulence, warm air rises from the surface to mix with winds aloft, bringing them down to the surface creating gusty conditions.

Eddy formation is a common characteristic of mechanical and thermal turbulent flow. Wind speed and direction, and the size and shape of the obstacles the wind encounters help determine eddy size, shape, and motion. Dust devils and fire whirls are examples of vertical eddies .

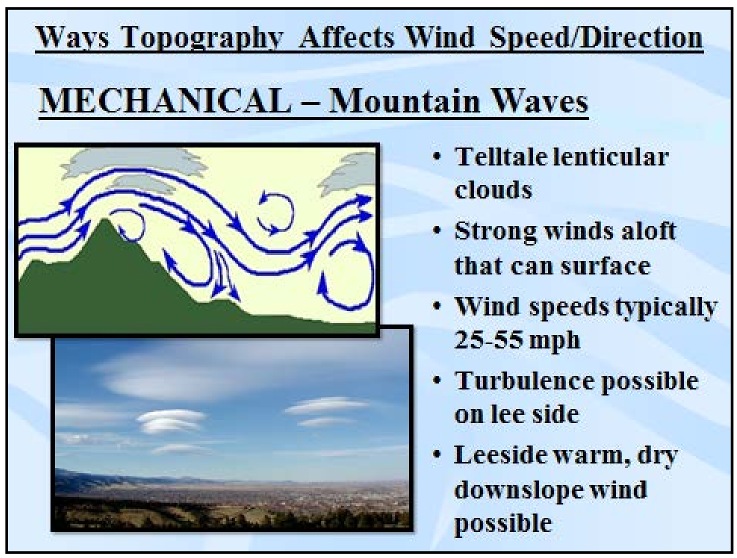


Figure 2.10. Mountain waves are common as moderate to high winds blow perpendicular to high mountain ranges, especially along the east slope of the Sierra Nevada Range.

Mountain waves are formed when moderate to strong winds in a stably stratified atmosphere blow across high mountain ranges. Their effects may be seen and felt for many miles downwind. The stable air, lifted by wind over the mountain range is pulled downward by gravity on the lee side of the range. Inertia carries the air past its equilibrium level so it rises again farther down slope forming waves. Lesser waves are formed down wind until the oscillatory action ceases. Important to firefighters is that the lee slope of the mountain range may experience strong down slope winds and eddies of varying sizes adversely affecting fire behavior. Down wind of the range, large rolling eddies may form with their axis parallel to the mountain range. If sufficient moisture is present mountain waves are recognizable by the cap clouds, resembling lenticular clouds, that form intermittently as the wave oscillates down wind of the range.

Diurnal Wind

The daily heating and cooling of the earth's surface create diurnal wind conditions. As surface temperatures increase, convection and radiation warm the air causing it to rise and move up slope and up canyon. Conversely, as air temperatures decrease, cooler air flows down slope and down canyon, much like water, taking the path of least resistance.

This process begins as the sun rises and heats the east facing slopes and continues around to the southern, southwestern, and western aspects as the afternoon progresses. Slope winds on the southern, southwestern and western aspects are generally the strongest during the heat of the day. Micro climates result from the air heating and cooling on different aspects at different times of the day in the same general area. Firefighters should remember that diurnal winds are subject to interruption or modification by general winds or large scale convective wind systems.

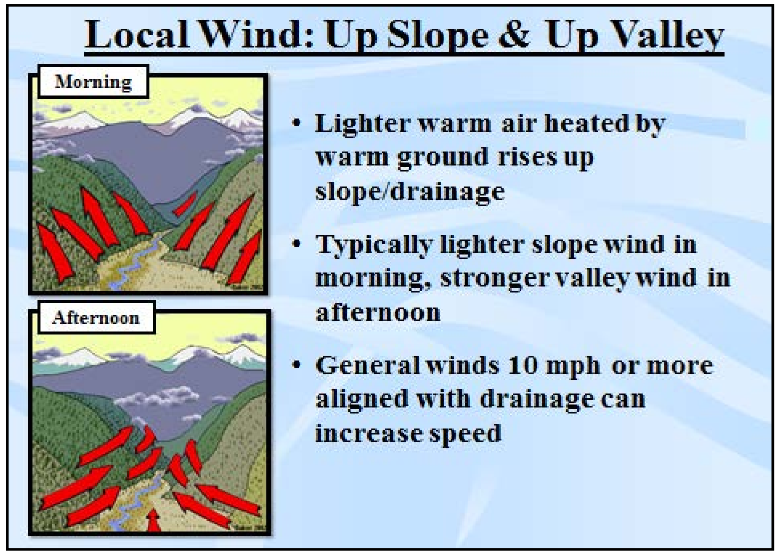


Figure 2.11. Diurnal wind influence may be quite different at the same time depending on the geographic location.

Frontal Winds

A front is the boundary between two air masses with differing temperature and moisture characteristics. A change in air mass is marked by the passage of either a cold front or a warm front. When a cold air mass replaces a warm air mass it is called a cold front. Conversely, when a warm air mass replaces a cold air mass it is called a warm front.

Fronts are located in troughs of low pressure. As the trough passes an area the wind direction shifts clockwise. The wind behavior exhibited by a cold or warm front is influenced by the speed of the front, the difference in air temperature between the air masses, and local conditions such as topography, and surface heating.

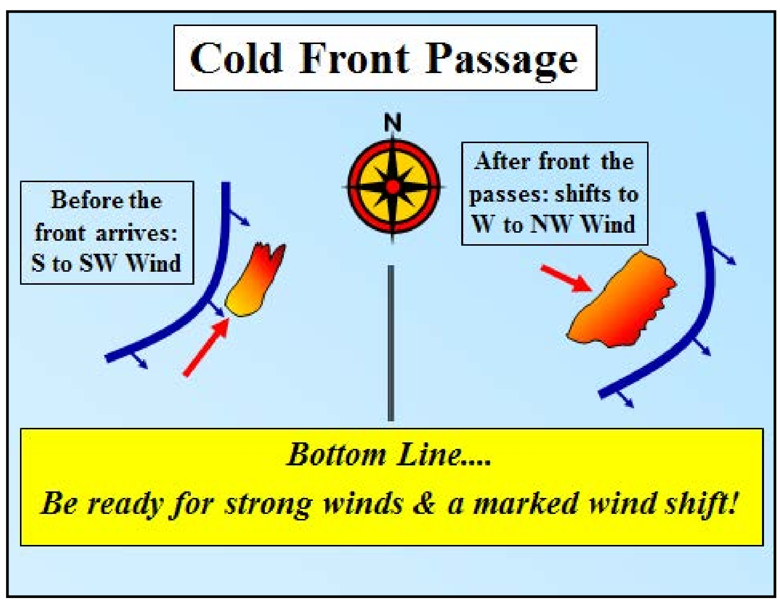


Figure 2.12. Of critical concern to firefighters are the wind shifts associated with frontal passage.

Figure 2.13 An approaching dry cold front is often preceded by the appearance of long, wispy, comma shaped "mare's tail" clouds, harbingers of changes in wind direction and speed.

Fronts are most often associated with thunderstorm activity and precipitation; however, frontal passage occasionally causes neither. The main concern for firefighters is the wind shifts associated with the frontal passage. Changing wind direction is the hallmark of frontal passage.

The passage of a cold front is usually accompanied by sharp, distinct directional changes in the wind. Ahead of a cold front, the surface winds are generally out of the south or southwest. As the front nears, wind speeds increase and become gustier. As the cold front passes, directional changes may be abrupt and change from as much as 45 degrees to 180 degrees. After the cold front passes, the wind direction will change again usually from the west to northwest or north. Winds may remain gusty for awhile but will generally become steady following frontal passage.

A forecasted dry cold front should concern every firefighter because of the possibility of abrupt wind changes and their influence on fire behavior. This wind change should be announced to incident resources whenever it is forecasted.

Glenwood Springs Colorado South Canyon Fire - July 6, 1994

A dry cold front passed over the South Canyon fire in Colorado causing extreme fire behavior that contributed to the deaths of fourteen firefighters.

Foehn (Föhn) Winds (Pronounced "Fern")

Foehn winds are usually associated with mountainous regions where a high pressure system occurs on one side of the mountain range and a corresponding low pressure system or trough occurs on the other. Foehn winds are more common in the cooler months of September through April and are also known as North, Mono, Chinook, East, Sundowner, and Santa Ana winds. Foehn winds are typically warm and dry and have been known to reach speeds of 100 miles per hour.

Fires influenced by strong foehn winds are difficult to contain using standard flanking or frontal tactics due to extreme spread rates and dramatic flame lengths and fire behavior. In coastal regions, foehn winds are influenced by the daily onshore and offshore cycle of the marine layer. As the marine layer recedes at night, Foehn winds may surface and accelerate raising havoc on the fire ground.

When foehn winds interact and compete with opposing general winds the condition is referred to as a battling wind and usually heralds a reversal of wind patterns. During the period of battling, the wind direction may fluctuate 180 degrees interrupted by brief periods of calm. A visible indication of battling winds is a wavering smoke column.

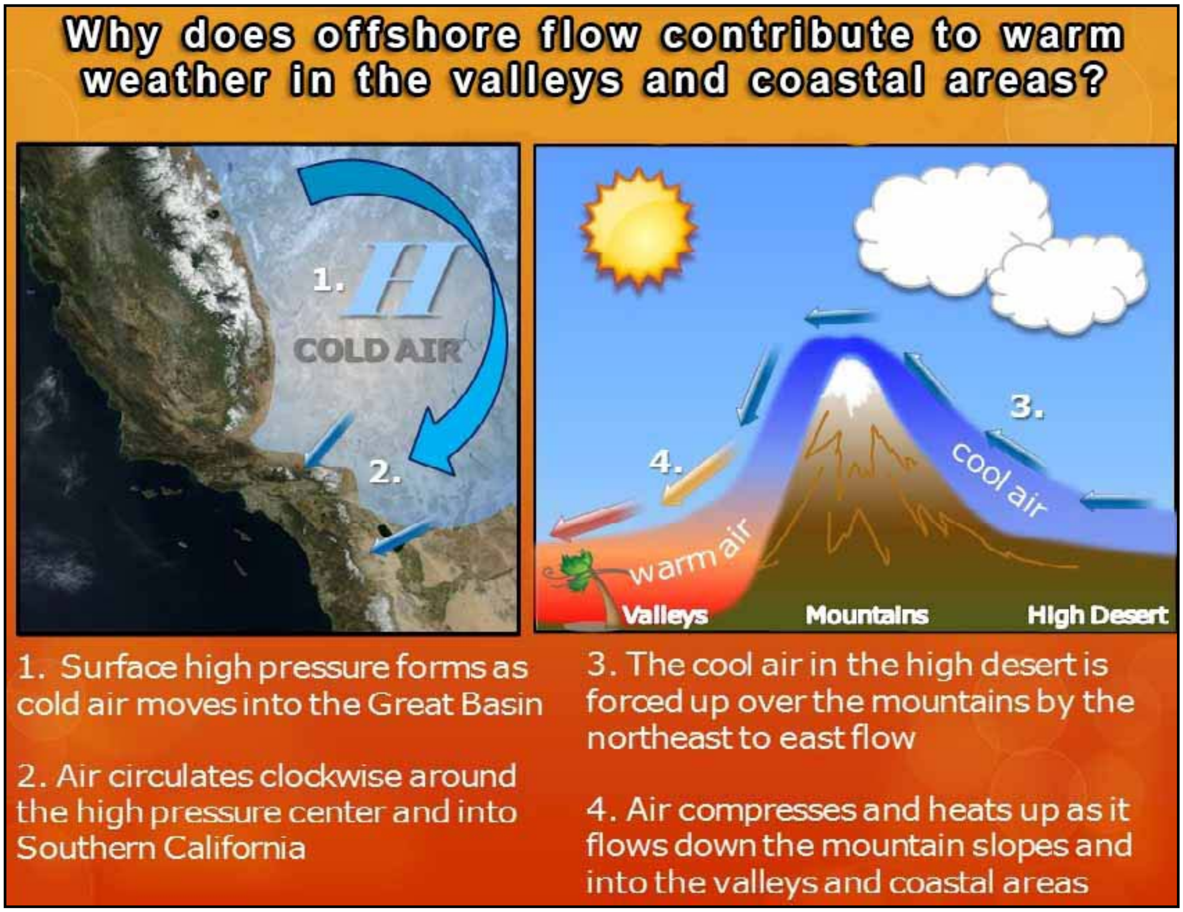


Figure 2.14. Foehn wind conditions generally occur in the cooler months from September through April.

During periods of strong off-shore winds, such as the Santa Ana winds in Southern California, a dry air mass tends to develop over the ocean just off the coastline. When the onshore winds establish themselves, the initial air mass will be dry due to the interior heating of the air mass. As weather patterns change, offshore winds subside and onshore winds develop, creating a 180-degree wind

San Diego County Cedar Fire - October 29, 2003

During one of the largest and most destructive wildfires in United States history, a significant onshore wind occurred after the offshore winds had diminished. During this event the fire crossed control lines and made a slope and wind aligned advance towards an engine company positioned at the top of a drainage engaged in structure defense. The engine company was overrun. One firefighter was killed and others injured.

shift over a wide geographic area. During this transitional period, firefighters should anticipate wind reversal. When the wind reverses, the fire will change direction. What was once the heel of the fire is now the fire head. A generally quiet area can flare up dramatically with sustained wind-driven runs. Resources must be ready for this event by securing the fire's heel before the wind changes direction.

Figure 2.15. Sundowner winds pushing the Jesusita Fire into the city of Santa Barbara.

Sundowner Winds

Sundowner winds are a phenomenon peculiar to the Santa Barbara and Ventura counties of California. Sundowners frequently occur in the late afternoon or evening hours – hence the name. Light sundowners create irregular rises in temperature with gentle offshore breezes. Stronger sundowners can create sharp temperature rises and local gale-force winds.

> ***Santa Barbara County Jesusita Fire - May 6, 2009***
>
> Several burnovers occurred simultaneouly when predicted sundowner winds surfaced and pushed the wildifre downhill at extreme rates of spread into the city limits of Santa Barbara. The fire had been benign in nature throughout the morning. Firefighters had been briefed in the morning that the winds may occur. Late in the afternoon, the sundowner winds and associated extreme fire behavior overwhelmed the firefighting forces, causing structural loss, burnovers, and firefigher injuries.

With explosive sundowners, super heated air from the valley bursts across the mountains onto the coastal plain, reaching gale force or higher speeds. Fires can race down the mountain slopes into populated areas along the coast.

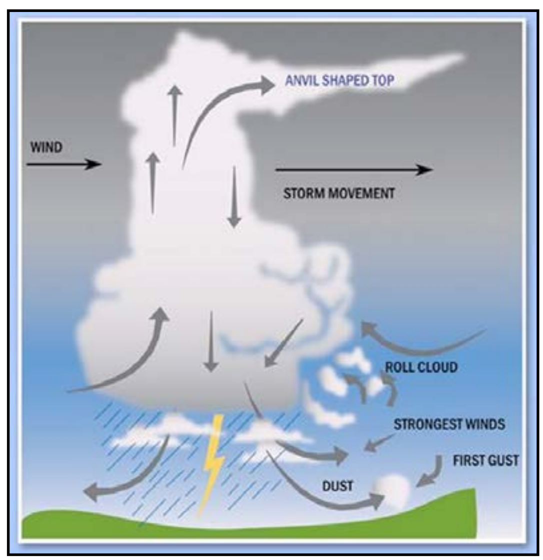


Figure 2.16. Mature thunder storm clouds, cumulonimbus, are easily recognizable and should be a concern to all firefighters because of their strong, gusty downdrafts.

Thunderstorm Winds

Thunderstorm winds can result from three different phenomenons:

- Updrafts predominating in and beneath growing cumulus clouds

- Downdrafts in the later stages of full thunderstorm development
- Cold air outflow from dissipating thunderstorms

Thunderstorm downdraft winds can be very gusty (up to 60 to 75 miles per hour) and follow the path of least resistance. Although appearing suddenly and violently, thunderstorm downdraft winds are generally of short duration and should be expected in the presence of any thunderstorm activity. Their effects can be felt miles away from the parent storm.

A building cumulus cloud over a fire may pull the convection column into the cloud's updrafts accelerating the inflow of surface oxygenated air into the fire area. Conversely, as the thunderstorm decays, the downdrafts from the cloud may push the fire outward in a 360 degree pattern. In either case, the resulting erratic winds may have a profound effect on the rate and direction of spread. Firefighters must anticipate control problems and safety issues as a result of thunderstorm activity near an incident. Competent lookouts should be posted under these conditions.

Figure 2.17. Whirl winds and fire whirls generated near, or traveling beyond the fire's edge, can transport and deposit fire brands over long distances causing numerous spot fires.

Whirlwinds and Dust Devils

Whirlwinds, or dust devils, are indicators of intense local heating and atmospheric instability. They are fairly innocuous in and of themselves; however, when generated inside or adjacent to the fire perimeter, the resulting fire whirl can spread embers causing numerous spot fires over a wide area. Fire whirls may reach tremendous speeds and heights carrying large brands and embers in unpredictable directions and may topple fire-weakened trees and snags near the fire perimeter. Whirlwinds and fire whirls may remain stationary or move with surface winds. Fire whirls are often generated in areas of concentrated heat within the fire perimeter and may be triggered mechanically by topographical features.

Temperature

Temperature affects not only fire behavior but also personnel behavior and capabilities. Excessive temperatures preheat fuels making them more receptive to ember cast or direct flame impingement ignition thus increasing the rate of spread. Likewise, high temperatures will have a harmful effect on incident personnel. As temperatures rise, production slows and personnel are more prone to heat-related injuries.

Solar Radiation Times by Aspect

Aspect	Time
East Aspect	0700 – 1000 Hrs
South Aspect	1000 – 1400 Hrs
Southwest Aspect	1200 – 1500 Hrs
West Aspect	1500 – 1800 Hrs

The influence of solar heating brings wildland fuels closer to their ignition temperature. Sunlit fuels are more receptive to fire spread. Solar radiation exerts a direct affect on fine fuel moisture content during daylight hours by heating the surface of the vegetation and driving off moisture. Conversely, shaded fuels will release moisture at a much slower rate.

Microclimates occur throughout the ecosystem depending on slope, aspect, and solar alignment. Solar heating and drying are most pronounced when the sun is shining directly on the slope. As the earth rotates, maximum solar exposure moves from east to west. East facing slopes receive the earliest direct sunlight in the cooler morning hours. South, southwest and west facing slopes receive maximum solar radiation as the sun reaches its zenith until it begins to set.

Atmospheric Stability

Atmospheric stability is the resistance of air masses, including smoke columns, to vertical motion. Atmospheric motion and the properties of the atmosphere that affect its motion greatly influence wildfires. Convective circulation established by surface heat created by a fire is directly affected by the stability of the air. Winds are more turbulent and gusty under unstable atmospheric conditions leading to erratic fire behavior.

Figure 2.18. Layered drift smoke, a light wispy smoke column, and a smoke column that does not rise to great heights are indicators of a stable atmosphere.

During unstable conditions, smoke columns, also known as convection columns, may rise to considerable heights forming cumulus clouds. Under unstable atmospheric conditions the atmosphere is usually quite clear and dust devils and fire whirls are more prevalent, winds are stronger and gustier, and inversions are very weak or non-existent. Conversely, when stable atmospheric conditions prevail, the sky is generally hazy with light, steady winds. Smoke columns may be light and wispy and inversions are more prevalent.

The Haines Index

The Haines Index is a severity index for wildland fires based on the stability and moisture content of the lower atmosphere and is a valuable indicator of large fire growth potential. The Haines Index is a numerical value ranging from 2 to 6 with 6 being the most unstable atmosphere.

2 = Very Low Potential (Moist Stable Lower Atmosphere)
3 = Very Low Potential
4 = Low Potential
5 = Moderate Potential
6 = High Potential (Dry Unstable Lower Atmosphere)

A Haines Index of 4 or below usually indicates low fire growth potential. A Haines Index of 5 or 6 is an indicator of potential large fire growth. Key elements that must be present for a Haines Index of 6 are instability and dry air. Instability affects fire behavior by enhancing the vertical rise of the smoke column, resulting in strong surface winds as air rushes into the fire area to replace air evacuated by the convection column. This is the mechanism by which fires create their own wind.

In the opinion of most of the fire weather forecasters in California, the Haines Index does not work well in California except on the east slope of the Sierras and Cascades. The reason is marine layer intrusion interferes with the calculations and gives a false instability signal of a 4 or 5 every day in the summer west of the Sierra crest.

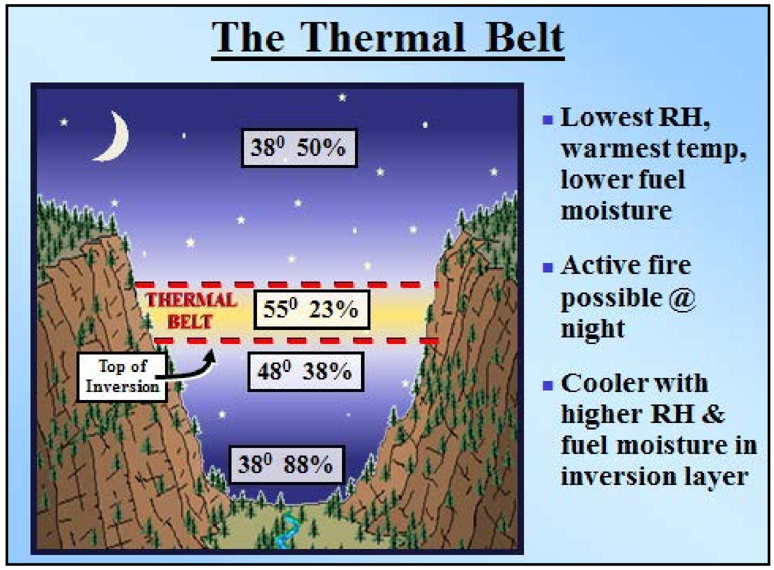


Figure 2.19. In the presence of an inversion, firefighters should expect active burning in the thermal belt at night.

Inversion Layers and Thermal Belts

An inversion is a layer of cold air trapped by a layer of warm air, usually in a valley, and acts like a lid or damper over the fire. Inversions are more common and more intense in valleys or basins with poor drainage. Inversions at night are common during periods of clear, calm, settled weather. Topography plays a key role in the formation and intensity of night inversions.

Figure 2.20. As the morning air warms and mixes, the fire overpowers the effects of the inversion and begins to actively burn.

Thermal belts are areas of trapped warm air sandwiched between two layers of cold air associated with an inversion. A thermal belt, characterized by above-average temperature and lower humidity at night, is generally found in the middle third of a slope. This area may experience active fire behavior throughout the night and should be monitored by incident personnel. Continue to monitor structures located in the thermal belt even though other parts of the fire are inactive.

Firefighters should expect to see subdued fire behavior under an inversion except within the thermal belt zone; however, fire behavior may increase rapidly as the inversion dissipates. Inversion dissipation generally occurs in the morning hours as the sun heats and mixes the air. As the inversion lifts, humidity decreases, fuels dry out, and winds increase. This action may cause extreme fire behavior compromising control efforts and creating serious safety concerns.

Relative Humidity

Relative humidity is the ratio of the amount of moisture in a volume of air to the total amount of moisture that volume of air can hold at a given temperature and atmospheric pressure. It is expressed as a percentage. Along with wind, relative humidity has a pronounced affect on fire behavior by affecting fuel moisture in dead fuels.

Fuel size determines how dead fuels are affected by relative humidity. Smaller diameter, lighter fuels (1-hour fuels) absorb and release moisture at much faster rates than will larger diameter, heavier fuels (1,000-hour fuels). If lighter fuels (1, 10, and 100-hour fuels) are carrying the fire, any change in relative humidity will be observed in these fuels first and is a primary indicator of changing fire conditions. Relative humidity will have a profound effect on the probability of ignition or *ignition component (IC)* because drier fuels ignite more readily than more moist fuels.

Ignition Component
Part of the National Fire Danger Rating System (NFDRS). A rating of the probability a firebrand will cause an actionable fire.

Generally speaking, temperature and relative humidity follow a daily pattern. As temperatures increase, relative humidity typically decreases. As temperatures decrease, relative humidity typically increases. Fire line weather observations must include relative humidity.

Figure 2.21. Firefighters should use every available tool for making real time weather and fire behavior forecasts on the fireline including hand-held weather devices or belt weather kits and Probability of Ignition Tables. Photo courtesy of Kari Greer.

Clouds

Clouds are visible evidence of atmospheric moisture, stability, and motion. The appearance of clouds during the fire season may indicate an imminent weather event that may adversely affect fire behavior and suppression efforts. Also, moisture that spawns thunderstorm clouds can be a common occurrence in the summer months. An overcast sky provides shade and a cooling effect, increasing fuel moisture in dead fuels. Rain may also be present with troughs or frontal passage increasing dead fuel moistures in 1, 10, and 100-hour fuels, affecting fire behavior.

Local heating results in thermal lifting and if the air contains adequate moisture and rises high enough, saturation will be reached and cumulus clouds will form. Moisture-laden air may be forced up the windward side of slopes by orographic lifting and cooling, forming clouds. As one air mass replaces another, air is forced upward by the passage of the front resulting in cloud formation and rain.

Firefighters should understand how clouds form and recognize how cloud types signal weather changes in order to make intelligent fire behavior forecasts.

Cloud Types

Cirrus clouds appear as thin veils covering the entire sky often forming halos around the sun. They may be wispy and feathery, are also known as "mares' tails," and may indicate an approaching front signaling changes in the wind patterns and overall weather outlook.

Stratiform clouds are formed when an entire layer of air lifts until it reaches condensation. They have a layered appearance and are associated with stable air

Altocumulus and *altostratus* clouds are middle clouds most generally formed by frontal or orographic lifting. Altocumulus clouds appear as rounded cloudlets or in definite patterns such as bands or rows parallel or at right angles to the wind.

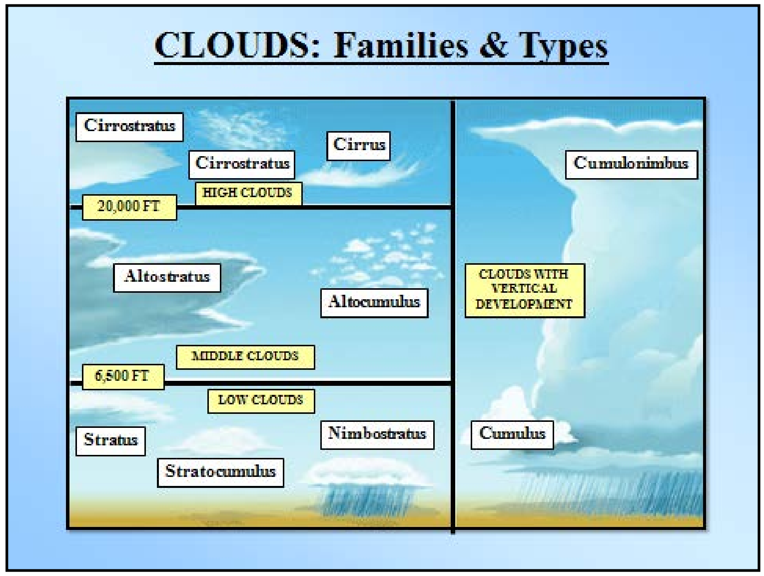


Figure 2.22. Cloud types.

Cumuliform clouds are formed by localized vertical currents which carry air upward beyond the condensation level. They are billowy or heaped–up in appearance and tend to form in air that is initially unstable or becomes unstable as it lifts.

Castallanus clouds consist of cumuliform masses that appear as turrets or small castles. They indicate significant instability at high atmospheric levels and their appearance in the early hours of the day are a warning of possible thunderstorms later in the day.

Cumulus clouds have vertical development and may appear as groups displaying large, irregular, cauliflower-shaped domes. The individual cloud bases are generally at the same altitude. Cumulus clouds are formed at the top of rising convection columns and their presence should be of particular concern to firefighters. Their formation signifies possible surface instability which may increase fire activity and compromise suppression efforts. A cumulus cloud, if it continues to form, will become a cumulonimbus cloud or thunderhead.

Cumulonimbus clouds are associated with strong erratic updrafts and downdrafts that influence fire behavior. Their appearance near or over the fire area should be of significant concern to firefighters.

Lenticular clouds, also known as mountain waves, indicate waves in the air flow caused by strong winds that typically blow across mountain ranges. Their appearance gives warning that the strong winds creating them may surface at some point during the day.

Adding fractus to a cloud name indicates that the cloud has been broken into fragments by strong winds. Adding nimbus as a prefix or suffix to a cloud name denotes clouds that produce precipitation.

Topography

Simply put, topography is the lay of the land, the slope, aspect, and undulations that give terrain its character. Computer mapping programs, topographic maps, and on site observations allow firefighters to:

- Anticipate problem areas such as steep slopes and drainages
- Utilize favorable topographic features for specific resources and strategies

Figure 2.23. Deep drainages will also rapidly funnel fire and convection columns downhill toward threatened structures, especially when influenced by Foehn winds.

Figure 2.24. Drainages often end at ridge lines forming saddles between two high points which will funnel wind and fire.

- Plan ahead for incident strategy and resource needs

Fire spreads significantly faster up a slope than on level ground. It can travel even faster up canyons and drainages, where wind direction is aligned with, and funneled into, these terrain features. Flame lengths extend up slopes allowing more fuel preheating and direct flame impingement ignition ahead of the fire front. When wind aligns with drainages, chimneys, and steep slopes, the resulting extreme rates of spread may become death traps for any resource caught in the path of the fire front. ICs should include this knowledge in the planning and briefing process.

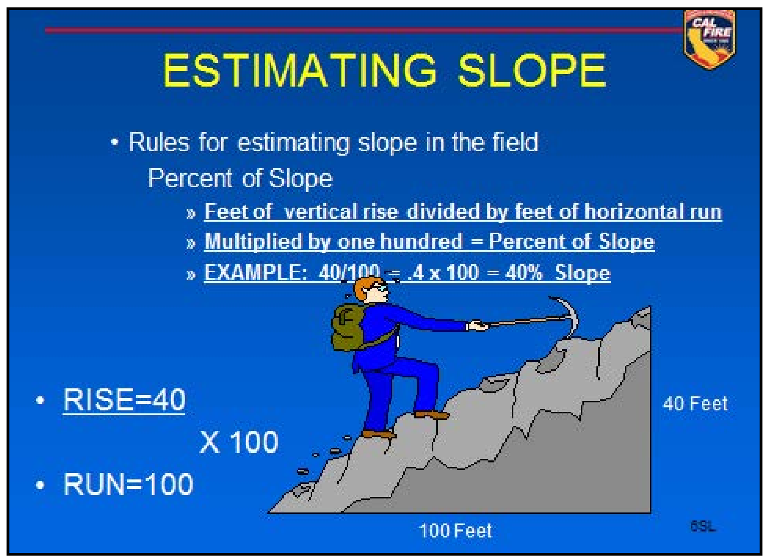


Figure 2.25. Firefighters should understand how to estimate slope to ensure that equipment limitations are not exceeded when deploying resources on the fireline.

Slope represents how much the elevation changes over a given distance. The higher the slope, the more steep the incline or decline. Slope is measured in degrees, ratios and grades. Slopes may be estimated from the ground or determined with reasonable accuracy from a topographic map. The formula for determining slope is: rise (the change in elevation between two points) divided by run (the horizontal distance between the two points) multiplied by 100 equals the percentage of slope.

Fuel, Weather, and Topography Aligned

Fuel, weather, and topography are the primary factors effecting fire behavior. Throughout the fire environment, using a single fuel model, variations can be observed in the fire's intensity, rate of spread, and consumption of live and dead fuel.

Wind, slope, and pre-heating of fuels are the primary forces effecting variations in fire behavior. Fire intensity is maximized when these forces are in alignment and reduced when they are not in alignment. Each area of a fire has a different alignment and intensity. Each alignment produces a signature, which is the observed fire behavior within the current alignment of forces.

When the wind is aligned with a steep canyon, the wind velocity will be increased due to compression of the wind; the steeper the canyon the stronger the winds. Fire history and case studies prove this point time after time.

Firefighters need to use extreme caution when these conditions occur; ensuring firefighter safety is the priority.

Figure 2.26. Steep, deep drainages, especially those that terminate in major river drainages, funnel and accelerate wind allowing for rapid and very intense fire runs. Photo courtesy of Kari Greer.

EXTREME FIRE BEHAVIOR

Crown Fires

With the right combination of slope, wind, and fuel arrangement, a surface fire may extend vertically into the surrounding vegetation.

Torching occurs when a single tree or small group of trees is suddenly and completely enveloped by fire in a very short time, usually seconds. Embers are lofted and spread with the wind and may result in spot fires contributing to the overall fire spread. If conditions do not favor the sustained ignition of adjacent crowns, the affected trees will burn out with no further crown-to-crown spread. Torching is common on fires where trees, especially conifer trees, are part of the fuel load. Torching is generally more prevalent during the hotter, drier periods of the day but also occurs at night.

Figure 2.27. Torching occurs when individual trees or isolated groups of trees suddenly erupt in flames.

Crown-to-crown spread occurs when any combination of wind, slope, and a dense

Figure 2.28. Running crown fires are classic indicators of extreme fire behavior conditions.

vegetation canopy combine leading to a sustained crown fire.

When winds increase, or the slope is such that flames are driven into adjacent tree crowns, the most probable result is a running crown fire. Steep slopes will accelerate the fire's spread especially with the presence of high surface winds and a closed canopy where tree crowns are intertwined. Wind-driven crown fires may run uphill for long distances but slow or even stop at predominate ridge lines where fuel conditions change.

Running crown fires most often produce large, boiling convection columns that may show signs of the winds influence by bending or hugging the ground. Expect ember showers and fire whirls.

Plume-Dominated Fires

A *plume-dominated fire* has overpowered local surface winds and winds aloft allowing the column to develop directly over the fire reaching tremendous heights without being sheared by upper level winds.

Plume-dominated fires are the result of a rapid build-up of heat caused by heavy fuel loading, an extremely dry fuel bed, and an unstable atmosphere. The vertical velocity of the convection column creates significant turbulence at the surface with increased in-drafts resulting in increased fire intensity and accelerated fire spread. This process is self perpetuating as the convection column grows. The towering convection columns tend to remain stable over the fire rather than bend in the direction of the prevailing wind. Plume dominated fires move erratically and can sprint over thousands of acres.

Plume-dominated Fire
A wildland fire situation where the heat and intensity of the convection column overpowers the influence of the prevailing wind.

If the convection column reaches tremendous atmospheric heights it may create a cumulous cloud capable of producing downdrafts which hit the surface and accelerate outward in all directions. Firefighters should watch for indicators of this dangerous condition, specifically the appearance of *virga* or actual precipitation in any amount that reaches the ground under or near the convection column.

The mere presence of a large, towering convection column should alert firefighters to the possibility of convection downdrafts. Like thunderstorms, downdrafts from convection columns are influenced by topography and have a tendency to follow the path of least resistance.

Virga
Wisps of precipitation evaporating before reaching the ground.

Riverside County Esperanza Fire - October 26, 2006

Fire firefighters were overrun while attempting structure defense at the top of a steep canyon aligned with a strong Santa Ana wind with single digit relative humidity. This fire was also in an area that had extremely low fuel moistures due to late season drying and drought conditions. When the fire accelerated through the canyon the bowl area above their position also experienced a 500+ acre area ignition which magnified the fire behavior and extreme conditions.

A plume weakens when its fuel is exhausted, the temperature drops, or a pyro-cumulus cloud formed on top of the column shades the fire ground below. The upward energy diminishes and cold air falls down the outside of the column. Rapidly descending downdrafts collapse the column, spreading fire in every direction. Embers can be deposited miles away from the fire by the force of the downdraft from the collapsed plume.

> Area Ignition
> Ignition of several individual fires throughout an area either simultaneously or in rapid succession and so spaced that they add to and influence the main body of the fire to produce a hot, fast-spreading fire condition. Also called simultaneous ignition.

Area Ignition

Area ignition is the ignition of several individual fires throughout an area, either simultaneously or in rapid succession, and so spaced that they add to and influence the main body of the fire to produce fast-spreading fire condition. Area ignition is a phenomenon associated with topography, fuel type, and heat.

Most area ignition events occur in topographical bowls or depressions. Certain box canyon configurations are also prone to area ignition. Area ignition results from the concentrated heating and volatilization of light to medium type fuels. These volatile vapors tend not to be dispersed by the wind or slope, but rather accumulate mixing with the surrounding air. The ignition source for area ignitions could be ember cast resulting in spot fires that ignite the area, or by vapors reaching an established section of the main fire and igniting. Area ignition is not dependant on the size of the area of involvement.

Figure 2.29. Area ignition is another indicator of extreme fire behavior conditions.

Slope Reversal

Slope reversal occurs when either backing fire or running fire burns downhill into an adjoining drainage and then runs uphill in a different direction. Continually monitor this fire behavior situation. Unless the downhill spread terminates at an anchored control line, there is a high probability that the fire will reverse direction once it establishes itself on an opposing slope.

Figure 2.30. Slope reversal defines a fire burning downhill, either backing downhill or influenced by a down slope wind, that crosses a drainage and quickly starts and uphill run on the opposite slope, usually with a dramatic increase in the rate of spread.

WUI-SPECIFIC FIRE BEHAVIOR

Fire spreads through various heat transfer processes including *radiation*, *convection*, and *conduction*.

In the WUI environment, direct flame impingement and *ember cast* must also be considered as potential heat transfer sources. During a WUI incident, structure ignitions and fire spread result from three primary sources:

- Radiant heat
- Convective heat transfer including ember cast
- Direct flame impingement

Weather and topography have a profound effect on structure-to-structure ignitions. Certain topographic features such as drainages, chimneys, and canyons funnel heat, wind, and convection columns, especially when these features are aligned with the prevailing surface wind. Structures located in or near these topographic features are at greater risk of direct flame impingement and ember cast ignition.

Structure-to-structure fire spread is primarily affected by construction type, structure configuration, structure density, the effects of weather and topography, and the ease of ignition of individual structures. Construction type and ease of ignition go hand in hand. Wood frame structures with flammable exterior siding and flammable roofs promote fire starts from almost every ignition source.

Radiation
Transmission of heat energy by electromagnetic waves passing from a heat source to an absorbing material such as forest fuels or structural components.

Convection
The transfer of heat by the motion of air or gases.

Conduction
Heat transfer through a material from a region of higher temperature to a region of lower temperature.

Ember Cast
Part of a convection column that includes glowing embers and burning materials transported by turbulence, usually in the direction of the wind, that can land in a receptive fuel bed and create spot fires.

Radiant Heat

In areas of dense structure arrangement, radiant heat plays a significant role in fire spread. There is a high probability that radiant heat from burning structures or vegetation in close proximity will ignite other structures.

Convective Heat

Convective heat transfer is a critical component for dispersing embers, and should be considered an important heat transfer process. Embers are spawned by burning vegetation and structures and spread by convection columns and general winds. When these embers land in a receptive fuel bed they ignite the fuel, continuing fire spread. The effects of ember cast are evident in areas of both dense and sparse structure placement.

Figure 2.31. During high wind events, a combination of convective heat, radiant heat, direct flame impingement and ember cast all contribute to structure to structure fire spread.

Wind and convection columns can transport embers over considerable distances and cause susceptible structures to ignite even without active fire spread in the immediate area. In the WUI, this method of fire spread is dramatically illustrated in areas with highly flammable roofing materials. If embers land on these roofs, these structures will ignite even with no vegetation burning around them.

Structures located in saddles, chimneys, steep canyons, and ridge tops are susceptible to ignition by convective heat transfer. These topographic features funnel hot air and gases upward, pre-heating fuels and structures in the fire path.

Figure 2.32. Structures located in drainages, on ridge tops, or mid-slope are susceptible to the heat and embers carried by large convection columns as well as direct flame impingement.

Direct Flame Impingement

Direct flame impingement is a form of conductive heat transfer. In areas of sparse structure arrangement, direct flame impingement is generally not a critical factor unless there are high winds or no defensible space around the structure.

When forecasting fire behavior in the WUI environment, firefighters need to consider how different types of heat transfer, coupled with the structure's heat exposure time and the time required to bring structure components to their ignition temperature, will influence their choice of tactics.

Wind Eddies Around Structures

Wind eddies around structures can drive embers into traps such as gable end vents, open windows, and other sheltered areas receptive to ignition. Structures with high or complex roof lines generally affect eddying more than structures with flatter roofs. Structures with numerous exterior wall angles promote wind eddies. Every structure should be assessed for wind eddy effects and the potential for eddies to deposit embers in ember traps.

FIRE BEHAVIOR FORECASTING TOOLS

Fire line supervisors should possess the ability to forecast fire behavior changes based on real-time observations and be able to make fire-behavior-driven tactical decisions from the fire line.

Fire line experience enhances the ability to observe current fire behavior and compare real-time observations to past events. When current fire behavior mimics a previous fire experience, experienced firefighters can anticipate that given similar fuel, weather, and topography, the current fire will behave in a similar way. This allows firefighters to make reasonable fire behavior forecasts.

The forecast process should also include historical fire data and the current fire's history. Because an area's topography, weather patterns, and fuel types generally remain the same over time, many areas experience fires in the same place time and time again.

Every IC should have access to a fire history map for the area. Fire history maps may span one or two generations if adequate records have been kept.

Local knowledge from farmers, ranchers, timber workers, and retired fire service personnel is another valuable fire behavior forecasting resource. These individuals may be able to offer historical insight supporting fire history map data.

Fire behavior forecasting tools available to the Incident Commander vary from basic to sophisticated and depend on the time and tools available to the IC. Some of the tools available include:

- Probability of Ignition tables in the Incident Response Pocket Guide: with belt weather kit observations ICs can rapidly assess the potential for spotfires. The use of this table is taught in the NWCG S-290 Intermediate Fire Behavior course.
- FLAME method: This quick estimation technique is taught in the NWCG S-290 course and facilitates forecasts of future fire behavior based on previous observations.
- Fire Behavior Tables in the NWCG Fireline Handbook Appendix B: these tables take the Incident Commander from belt weather kit observations to a fire behavior forecast addressing flame length and rate of spread. The use of the tables is taught in the NWCG S-390 course.
- Wildland Toolkit App for iOS: on portable devices this program can be used instead of the Probability of Ignition Table and Fire Behavior Table and provides a fire behavior forecast in seconds. It includes calculators for relative humidity, fine dead fuel moisture and probability of ignition.
- BEHAVE Plus: The current version of BEHAVE Plus has a Surface Fire Spread forecast module which includes calculators for relative humidity, fine dead fuel moisture and probability of ignition.

Campbell Prediction System

The Campbell Prediction System (CPS) is a quick and practical way to predict, verify, and communicate when and where wildland fire behavior changes can occur. The CPS' focus is to predict fire behavior changes and potential for dangerous fire intensities.

In firefighting situations, the observed fire behavior becomes the baseline for fire behavior forecasts. These observations include the forces of wind, slope, and pre-heating, and their relation to one another.

The CPS teaches firefighters how to use logic rather than intuition to make decisions on the fire line. It teaches a language to communicate the observed and forecasted fire behavior. Using the CPS, firefighters learn how to discuss a fire's potential, increasing the opportunity for a safe and effective firefighting operation.

The CPS helps the user:

- Identify and utilize appropriate fire line observations to make fire behavior forecasts
- Explain the forecast for the change in fire behavior
- Select appropriate strategy and tactics
- Articulate the justification for that selection
- Animate the forecasted fire behavior on a map

An extension of the CPS is the CPS Wildfire Management Tool, a software package that encompasses some aspects of BEHAVE with the CPS language.

For more information about WFDSS, visit http://wfdss.usgs.gov/wfdss/WFDSS_Home.shtml

Geospatial Fire Analysis Applications

Wildland Fire Decision Support System (WFDSS)

The Wildland Fire Decision Support System is a suite of applications that are intended to support the selection of various strategies and management alternatives in a wildland fire situation. All of these applications run on remote servers and can be supported by an on or off site Fire Behavior Analysts. The WFDSS includes different applications meant to support different time horizons. The table below describes the different modules and the situations where their use may be appropriate. All of the modules include surface fire and crown fire behavior estimation, and spotting estimation. All of the systems simulate fire across a landscape described in dimension by the user. All the models used are based on the 1972 Rothermel Fire Model and have the same limitations and assumptions as taught in S-390 and S-490.

Old System	New WFDSS	Time Horizon	Weather Scenario	Strategy Situation
BEHAVE	Basic Fire Behavior	Minutes	Single	IA
FlamMap	Short Term Fire Behavior	Hours	Single	Extended Attack
FARSITE	Near Term Fire Behavior	Days	Changing Over Time	Major Fire
RERAP	FSPro	Weeks, Months	Multiple Historical	Long Term Fire

FlamMap, FARSITE, and FSPro

In the last few years there have been significant changes regarding the decision support and fire behavior forecasting tools available as stand-alone personal computer or remote off-site applications. Some of the most popular are FlamMap and FARSITE (stand-alone applications) and FSPro, a web-based application found in the federal fire applications system.

Collectively referred to as Geospatial Fire Analysis Applications, all of these applications utilize geospatial data from GIS (geographic information system) to model fire spread utilizing the Rothermel fire spread equations which produce an array of fire decision support outputs.

Historically, the lack of compatibility between the GIS data and the various tools led to intensive set-up time. By adding these tools to the existing Wildland Fire Decision Support System (WFDSS), the location of FSPro, uniform and consistent data made the tools more accessible and easier to use. This transition led to changing the application names to reflect the nature of their outputs.

THE FORTY FUEL MODELS FOR FIRE BEHAVIOR CALCULATIONS

Row	Fuel Model Group	FM Code	FM Number	Fuel Model Descriptive Name
1	Grass	GR1	101	Short, Sparse Dry Climate Grass (Dynamic)
2		GR2	102	Low Load, Dry Climate Grass (Dynamic)
3		GR3	103	Low Load, Very Coarse, Humid Climate Grass (Dynamic)
4		GR4	104	Moderate Load, Dry Climate Grass (Dynamic)
5		GR5	105	Low Load, Humid Climate Grass (Dynamic)
6		GR6	106	Moderate Load, Humid Climate Grass (Dynamic)
7		GR7	107	High Load, Dry Climate Grass (Dynamic)
8		GR8	108	High Load, Very Coarse, Humid Climate Grass (Dynamic)
9		GR9	109	Very High Load, Humid Climate Grass (Dynamic)
10	Grass-Shrub	GS1	121	Low Load, Dry Climate Grass-Shrub (Dynamic)
11		GS2	122	Moderate Load, Dry Climate Grass-Shrub (Dynamic)
12		GS3	123	Moderate Load, Humid Climate Grass-Shrub (Dynamic)
13		GS4	124	High Load, Humid Climate Grass-Shrub (Dynamic)
14	Shrub	SH1	141	Low Load, Dry Climate Shrub (Dynamic)
15		SH2	142	Moderate Load, Dry Climate Shrub
16		SH3	143	Moderate Load, Humid Climate Shrub
17		SH4	144	Low Load, Humid Climate Timber-Shrub
18		SH5	145	High Load, Dry Climate Shrub
19		SH6	146	Low Load, Humid Climate Shrub
20		SH7	147	Very High Load, Dry Climate Shrub
21		SH8	148	High Load, Humid Climate Shrub
22		SH9	149	Very High Load, Humid Climate Shrub (Dynamic)
23	Timber-Understory	TU1	161	Low Load , Dry Climate Timber-Grass-Shrub (Dynamic)
24		TU2	162	Moderate Load, Humid Climate Timber-Shrub
25		TU3	163	Moderate Load, Humid Climate Timber-Grass-Shrub (Dynamic)
26		TU4	164	Dwarf Conifer with Understory
27		TU5	165	Very High Load, Dry Climate Timber-Shrub
28	Timber Litter	TL1	181	Low Load, Compact Conifer Litter
29		TL2	182	Low Load Broadleaf Litter
30		TL3	183	Moderate Load Conifer Litter
31		TL4	184	Small Downed Logs
32		TL5	185	High Load Conifer Litter
33		TL6	186	Moderate Load Broadleaf Litter
34		TL7	187	Large Downed Logs
35		TL8	188	Long-Needle Litter
36		TL9	189	Very High Load Broadleaf Litter
37	Slash-Blowdown	SB1	201	Low Load Activity Fuel
38		SB2	202	Moderate Load Activity Fuel or Low Load Blowdown
39		SB3	203	High Load Activity Fuel or Moderate Load Blowdown
40		SB4	204	High Load Blowdown
41	Nonburnable	NB1	91	Urban/Developed
42		NB2	92	Snow/Ice
43		NB3	93	Agricultural
44		NB8	98	Open Water
45		NB9	99	Bare Ground

Figure 2.32.1. Fire Behavior Fuel Models, from Scott & Burgan's Standard Fire Behavior Fuel Models.

Short Term Fire Behavior

Historically referred to as FlamMap, this system uses the Minimum Travel Time (MTT) portion of FlamMap. Utilizing basic BEHAVE Plus outputs, it calculates minimum travel times between points across a landscape represented through GIS. The output generally provides the theoretical major fire pathways that a modeled fire may take under consistent environmental conditions (fuel, moisture, and winds).

Near Term Fire Behavior

Historically referred to as FARSITE, this system utilizes various GIS spatial data to model the growth of a given fire scenario under diverse weather conditions. The output resembles a progression map or progression model showing the fire's growth with time interval lines indicating a predetermined time interval between lines. Estimates of projected acreage, distance, and fire behavior outputs can be determined using mapping outputs or analysis reports. In addition to incident applications, this tool is often utilized for planning and fire perimeter reconstruction.

Long Term Fire Behavior

Fire Spread Probability (FSPro), historically referred to as RERAP, utilizes highly complex statistical analysis modeling to determine the probability a fire, under historically likely weather scenarios, will reach a given point on the landscape as represented on a map. Unlike fire progression maps, these maps indicate the statistical probability, represented as a percentage, of a fire reaching a given point away from the current fire perimeter. These maps basically answer the question: "What is the chance of the fire reaching this point on the map?" They do not attempt to show a projected perimeter or projected acreage.

Rapid Assessment of Values at Risk (RAVAR)

RAVAR is a fire economics tool typically utilized in conjunction with FSPro to make risk assessments of primary resource values threatened by an ongoing large fire. RAVAR uses GIS data and tools typically integrated with the FSPro model to identify the likelihood of high-value resources (as defined by the incident objectives) being impacted by the fire. RAVAR can evaluate structures and critical infrastructure threatened by the fire and assess non-monetary values such as critical habitat, cultural heritage sites, and other resources where GIS data is available.

National Fire Danger Rating System (NFDRS)

The following three NFDRS adjectives can assist firefighters in making fire behavior forecasts.

Burning Index **(BI)** – is a number that relates the contribution of a fire's behavior in containing the fire.

> Burning Index
> A number that relates the contribution of a fire's behavior in containing the fire.

Containment difficulty is directly related to fire line intensity (BTU's/ft/sec). This is the heat release along the fire perimeter at its head. Ratings are for the worst conditions in the Fire Danger Rating Area. A unique burning index (BI) table is required for each fuel model.

The burning index reflects the changes in fine fuel moisture content and wind speed and is highly variable day to day. The burning index is more appropriate for short-term fire danger and can be loosely associated with flame length by dividing the burning index by 10. The burning index is readily affected by wind speed and fine fuel moisture.

The burning index can:

- Integrate the combined effects of *spread component* (SC) and *energy release component* (ERC).
- Serve as a guide for staffing or readiness levels, and adjective ratings (low, moderate, high, very high and extreme).

> Spread Component
> An estimate of the spread of a fire at its head.

Ignition Component (IC) – is an expressed probability that a firebrand will cause an actionable fire, one that requires suppression action.

> Energy Release Component
> The computed total heat release per unit area (British thermal units per square foot) within the flaming front at the head of a moving fire.

The ignition component is a number which represents the probability that a fire will result if a fire brand is introduced into a fine fuel complex. The ignition component can range from 0 when conditions are cool and damp, to 100 on days when the weather is dry and windy. Theoretically, on a day when the ignition component registers a 60 approximately 60% of all fire brands that come into contact with wildland fuels will require suppression action. Three distinct inputs must be provided in order to calculate the ignition component. They are fine dead fuel moisture, air temperature (dry bulb) and the shading of the fuels.

Spread Component (SC) – is an estimate of the spread of a fire at its head.

It is projecting the potential rate of a fire's spread at its head in feet per minute under the assumed weather, fuels, and topographic conditions associated with the fire danger rating area. Wind speed, slope, and fine fuel moisture are key inputs in the calculations of the spread component which accounts for a high variability from day-to-day. The spread component is expressed on an open-ended scale; thus it has no upper limit. If the SC=20 then the forward rate of spread is predicted to move at 20 feet per minute.

The spread component can:

- Guide the need to pre-position or stage suppression resources to reduce travel time.
- Guide acceptable initial attack response times to keep fires to an acceptable size.
- Assist in determining the types of fire line resources sent on initial attack.

Fire Danger Pocket Card

The *Fire Danger Pocket Card* is a synopsis of fire danger information for a specific area that serves as a visual aid for firefighters. The goal of the Pocket Card is to enhance a firefighter's understanding of local conditions affecting fire behavior in a specific area and to enhance situational awareness.

> Fire Danger Pocket Card
> A situational awareness tool, provided by the NFDRS, that provides a method for those involved with wildland and prescribed fire operations to communicate a common understanding of key index values.

Each Pocket Card contains historical and interpretive information. The information on the card should be representative of a wide area, such as the north or south portion of a fire zone or a section of a state or national forest.

Firefighters can use the Pocket Card to make a general assessment of fire potential based on local weather conditions, historical fire occurrence, and interpreting fire danger ratings for a local area.

The upper left quadrant has a color graph that shows the historical worst and average seasonal

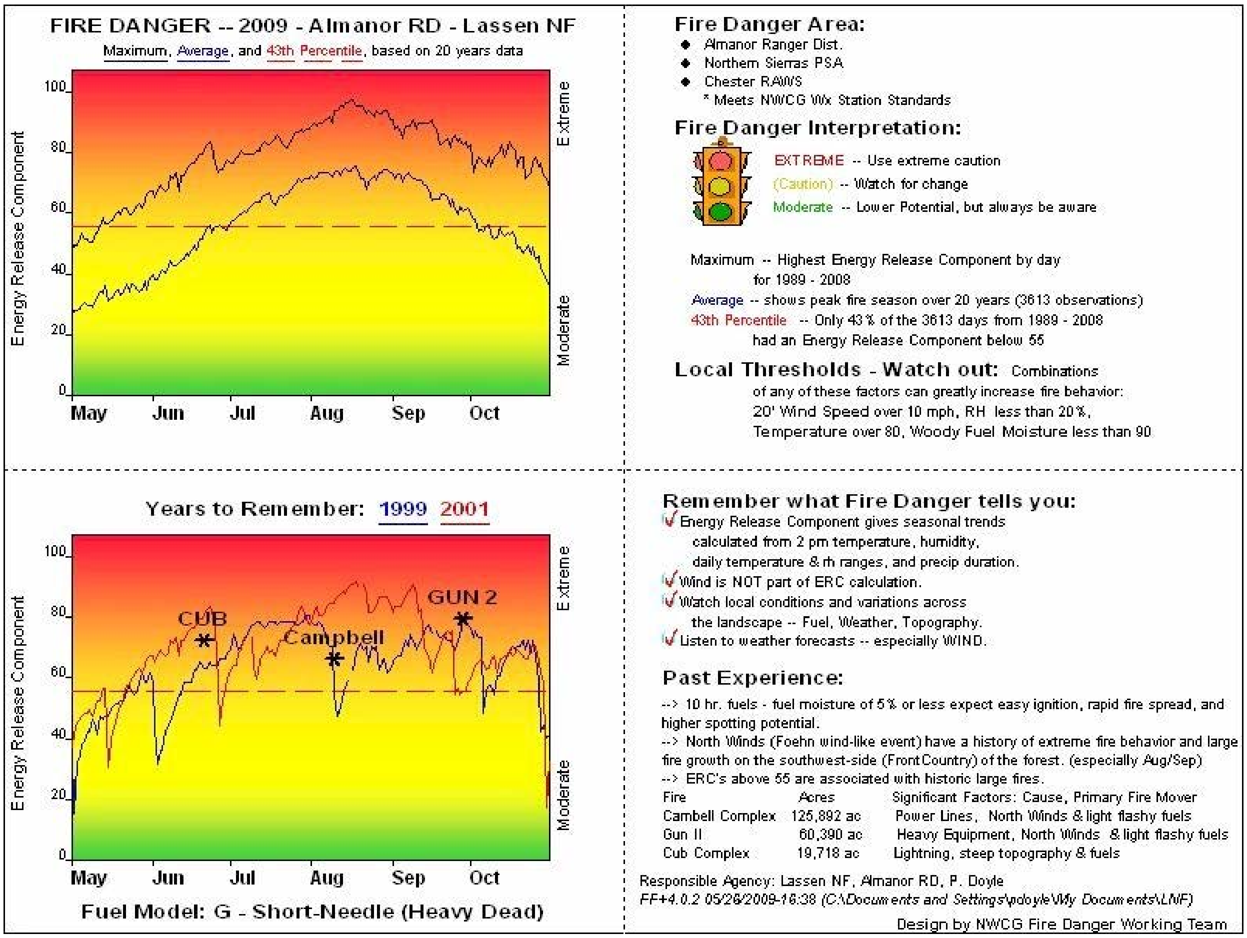


Figure 2.33. The pocket card provides firefighters a snapshot of the fire behavior conditions that may be expected for a given area.

trends for the fire danger rating output that best illustrates local fire activity. The firefighter should be provided with the current BI or ERC so the current situation can be compared to the average and worst situations.

The lower left quadrant has color graph showing specific years to remember: one with relatively low fire activity and the other with a relatively active fire season. Significant fires are labeled on the seasonal curve for either year.

The color bands of both graphs are adjusted to reflect local conditions.

These graphs serve as a tactical guide to suppression options based on the fire danger rating. The suppression options are spelled out next to the stoplight icon in the upper right quadrant.

The upper right quadrant lists the geographical area covered by the card. The card's information is specific to that area and should not be used for any other area. The upper right quadrants also includes the weather data sources used to make the card and local weather factors of critical safety concern.

The lower right quadrant includes data on significant past fire activity and a checklist to remind firefighters about energy release component (ERC) calculations.

Fire Characteristics Chart

The Fire Characteristics Chart, also known as the Haul Chart, uses rate of spread, fire line intensity, and flame length to categorize fire behavior as low, moderate, active, very active, or extreme. The resource icons within each category indicate recommended resources based on fire behavior and intensity.

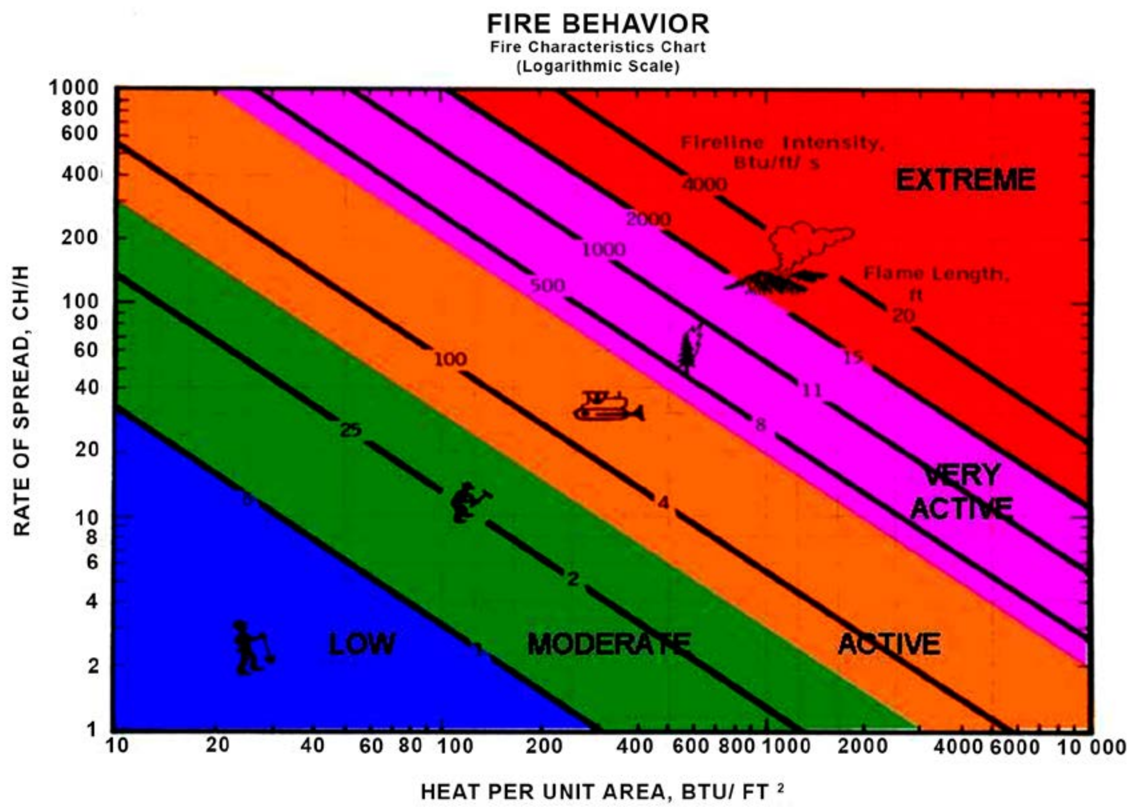


Figure 2.34. The Fire Characteristics Chart is a tool to determine strategy and tactics based on fire intensity.

Using the Haul Chart can assist firefighters in making safe and effective tactical decisions about resource utilization on actively burning fire lines.

Fire behavior for this application is best described in terms of fire line intensity in feet of flame length and rate of spread in chains per hour. The Haul Chart plots fire behavior in terms of heat per unit area released as BTUs per square foot (X axis) versus rate of spread as chains per hour (Y axis). Fire line intensity expressed as BTUs per square foot is difficult to estimate on the fire line. However, flame lengths in feet and rates of spread in chains per hour may be estimated with reasonable accuracy on the fire line.

Fire Weather Forecasts

Twice daily the National Weather Service issues a fire weather forecast for specific areas (weather zones) throughout the state. This forecast provides trends and specific information for each zone. Depending on the administrative unit, this information may be read over the radio and/or distributed by e-mail. Firefighters are encouraged to use this information in making fire behavior forecasts.

A *Fire Weather Watch* is issued to report on conditions, expected to develop in the next 12 to 48 hours, but not more than 72 hours, which could result in extensive wildland fire occurrence or extreme fire behavior. In cases of dry lightning, a Fire Weather Watch may be issued for the next 12 hours.

A *Red Flag Warning* alerts firefighters to ongoing or imminent critical fire weather patterns that may occur within the next 24 hours. Forecaster confidence is generally high.

Fire Weather Watch
A warning issued to advise of conditions which could result in extensive wildland fire occurrence or extreme fire behavior, which are expected to develop in the next 12 to 48 hours, but not more than 72 hours. In cases of dry lightning, a Fire Weather Watch may be issued for the next 12 hours.

Red Flag Warning
A term used by fire weather forecasters to alert forecast users to an ongoing or imminent critical fire weather pattern.

Remote Automated Weather Station (RAWS)

A remote automated weather station (RAWS) transmits weather observations. RAWS are located throughout the world and provide real-time and historical data related to weather at that particular site. This information is readily available on the internet and firefighters are encouraged to become familiar with and be able to interpret the information.

Visual Indicators of Extreme Fire Behavior

Firefighters at or en route to the scene should be able to interpret fire behavior based on visual indicators including:

- Sheeting: large areas of surface fire fanned by high winds
- Sustained crown runs
- Area ignition
- Long-range spotting
- Multiple large spot fires
- Horizontal vortices associated with smoke columns under the influence of high surface winds
- Flame lengths in excess of 20 feet
- Significant fire whirls
- Spread rates in excess of 3 miles per hour
- Plume-dominated fire

Figure 2.35. Fire behavior analysts use RAWS placed through the fire area to gather the weather data needed to make effective fire behavior forecasts.

Accurate fire behavior forecasting is crucial when developing objectives, determining strategy and tactics, and placing resource orders. Firefighters should consider all fire environment factors when forecasting fire behavior and should anticipate changes in the fire environment that will effect fire behavior and drive command decisions.

Chapter
3

INCIDENT COMMAND

From initial attack through incident resolution, incident command is vital to the successful conclusion of a WUI incident. Building on the foundation established during pre-planning and initial attack size up, the incident commander oversees all aspects of the incident action plan and its execution. No matter the level of incident command: initial attack, extended attack, or major incident, incident commanders must rely on their experience and training to make sound, timely decisions based on current and forecasted fire behavior, and accurate intelligence gathered from fire line supervisors and aerial resources.

PRE-INCIDENT ACTIVITIES

Fire History and Area Orientation

Ideally, anyone who may command a WUI incident should be very familiar with area geography and fully understand the factors that influence fire behavior in that area. Chief officers and company officers should make it a point to become intimately familiar with their initial attack area. Targeted road orientation reinforced with aerial observation provides the best intelligence. Maps and Internet mapping technologies are also valuable tools. Make notes of WUI areas including the numbers and types of structures that may be threatened by a fire in those areas.

Choose a target area and ask these three questions:
- What strategy and tactics should be employed if a fire started here?
- What problems might occur? (evacuation, road access, infrastructure, etc.)
- How will the fire behave?

Commanding a hypothetical incident based on real-time observations gives incident commanders (ICs) an opportunity to develop and implement a plan, formulate a strategy, develop tactics, and order and deploy resources. Commanding a hypothetical incident might reveal that the incident is more complex than originally thought and that, if real, would present multiple problems.

Fire history maps are an excellent but often under used, pre-planning resource. Anyone who may command a WUI incident should have a detailed map of past fires in the initial attack area. Research historical fires and it becomes obvious that ICs address similar incidents with similar problems and similar solutions year after year. Command officers should research the weather and fuel conditions of historical fires and be cognizant of repeat conditions heralding a similar fire situation.

Seek out more experienced fire service personnel to discuss past fires and what strategies and tactics they used. They can be a wealth of experience and knowledge about past fires in the initial attack area. Learn from their successes and their challenges.

When conducting fire history research, ask these questions:
- What strategies and tactics were used on this fire?
- What worked and what didn't work?
- Where were the problem areas?
- What were the problems?

Pre-incident Plan
A two-part document consisting of a map and a written plan to help responding personnel effectively command a WUI incident.

Pre-Incident Plans

A *pre-incident plan* is a two-part document consisting of a map and a written plan to help responding personnel effectively command a WUI incident. A pre-incident plan is one of the most valuable tools available for accelerating the incident planning process. Pre-plans are discussed in detail in chapter 9.

Created before an incident occurs, a pre-plan should be validated through inter-agency training exercises to prepare local suppression forces for the possibility of an incident in the planning area. It enables the IC to rapidly develop incident priorities, objectives, strategies, and tactics based on previously gathered intelligence and information.

If a pre-incident plan exists, the IC should review and fully understand it. If a planning area does not have an up-to-date pre-incident plan, creating one should become a priority for area personnel.

Figure 3.1. Any firefighter who may act as an IC must have a solid understanding of local topography, geography and fire history. Drive around and observe at risk or fire prone neighborhoods from the ground and view the same neighborhood from the air if possible.

ACTIVE INCIDENT ACTIVITIES

Initial Attack Response

Pre-Arrival

Anyone responding to an incident should begin to gather information about available resources and fire behavior en route to the incident.

Resource considerations:
- Where is the fire burning and are pre-plans available for the particular area?
- What resources are available in the initial attack area and surrounding jurisdiction?
- What resources will likely arrive at the incident first?
- Are other incidents influencing resource availability?
- Are specific resources at critical draw down levels?
- Will *reflex time* be an adverse factor affecting initial attack success?
- Will the topography require specialized resources?
- Have air resources arrived on scene before ground resources?
- Has the initial air resource ordered additional resources?

Reflex Time
The elapsed time between ordering the resource and when the resource is deployed on the fire line.

Figure 3.2 While en route to an initial attack incident, observe the smoke column. Is it dark, billowing and towering? Or...

Figure 3.3. Or is the smoke column light and wispy?

Fire behavior observations:

- What does the smoke column look like? Is it dense, towering, and well defined or thin, wispy, and hard to see?
- Is the column's condition appropriate for the report on conditions?
- Translate the condition of the smoke column and its relationship to the weather conditions in the fire area.
  - Is there an inversion over the fire?
  - Is the column sheared by strong winds?
  - Could this be a plume-dominated incident where the power of the convection column is greater than that of the wind?

The first resource to arrive at the incident becomes the initial attack IC and gives the report on conditions to the emergency command center (ECC). While en route, the responding chief officer should monitor the report. Command officers should also pay close attention to the first report from any air resource.

Figure 3.4. Does the smoke column appear to be influenced by strong winds aloft?

Report on conditions considerations:

- What is the first report on conditions?
- What is the demeanor of the individual giving the first report (calm and focused or agitated and possibly overwhelmed)?
- Is the initial attack IC a seasoned company officer with extensive background or a relatively new officer with limited experience?
- Does the initial resource order align with the report on conditions?
- Has there been any mention of threat to life or hazardous or high risk situations?

Intelligence gathering en route does not mean commanding the incident en route. However, there may be times when, based on additional information, a company or chief officer augments the initial resource request before arriving on the scene.

Arrival at Scene

The initial attack IC plays a pivotal role in establishing the incident's plan and organizational structure. The IC's plan should include objectives, strategy and tactics that may remain in place throughout the duration of the incident. The organizational structure established by the initial attack IC sets the stage for expanding the incident organization if the incident escalates.

Figure 3.5. Chief officers should monitor the initial attack IC's first report on conditions. What is the demeanor of the IC? Does the report on conditions align with the appearance of the smoke column?

Upon arrival, the initial attack IC must balance two command priorities: suppression and command.

Suppression

Initial attack ICs should focus on this priority if they believe they can stop the fire spread quickly with support from initial attack resources. If it is obvious that initial attack efforts will not significantly slow or stop the spread of the fire, or if the fire is already well established upon arrival, the initial attack IC should focus on command.

Command

The initial attack IC should establish an incident command post and take command of the incident by:

- Establishing *incident objectives*
- Formulating a plan based on current and forecasted fire behavior and values at risk
- Establishing incident strategies and determining incident tactics
- Deploying and directing incoming resources
- Ordering additional resources based on tasks to be completed
- Establishing the incident organization
- Establishing staging areas
- Starting the mapping process

Incident Objectives
Statements of guidance and direction necessary for the selection of appropriate strategy(s), and the tactical direction of resources. Incident objectives are based upon agency administrators direction and constraints. Incident objectives must be achievable and measurable, yet flexible enough to allow for strategic and tactical alternatives.

Ordering, assembling, and deploying resources is a critical command function. Contact the ECC to place an immediate-need resource order. This order focuses on critical resources needed as soon as possible such as engines for immediate structure defense, dozers to open roads or fuel breaks, extra aircraft, etc.

Size Up

Completing an accurate size up is absolutely critical for initial attack success. Size up includes evaluating fire behavior and identifying evacuation needs, area closures, ground and air hazards, and values at risk including residential structures, out buildings, commercial buildings, historical sites, threatened and endangered habitat, and other exposures.

When structures are threatened, the initial attack IC must decide if the threat demands immediate intervention or if a perimeter control strategy should be utilized to stop the fire spread eliminating the threat to structures. The IC must take decisive action in either situation. It is unsafe and unacceptable to take a stand at a structure, or group of structures, and let the fire front advance to that position when there is ample time to initiate perimeter control action.

If the incident threatens multiple structures or entire neighborhoods, address the need for area closures and evacuations as early as possible. Based on current and forecasted fire behavior, the IC may designate one or more protective actions:

- Evacuation warning: Prepare civilians to evacuate
- Evacuation order: Civilians leave the area, typically a long-term event
- Shelter in place: Civilians remain in the immediate area
- Safe refuge area: Civilians move to a safe area relatively close to the threatened area

Size up also includes identifying hazards or special situations that may directly compromise safety or affect suppression efforts. These situations are numerous and may include:

- Life threat to civilians or responders
- Power lines as a hazard for aircraft or an electrocution hazard for ground resources
- Bridges with load limits or structural integrity issues that prohibit access
- Heavy traffic exiting the area or traffic jams
- Hazardous materials involved in the fire

After a thorough size up of the incident, the IC should compile a consolidated resource order listing resource kind, type, and configuration. This order is well thought out and delivered in one communication. When ICs request one or two resources now and one or two more resources ten-minutes later, they increase dispatcher confusion and extend reflex time. Don't forget to include fire line overhead and support personnel in the consolidated resource order.

Report on Conditions

The initial attack IC provides the ECC with an adequate report on conditions as soon as possible after arrival

Figure 3.6. The initial attack IC must decide whether to continue with the initial attack or identify the ICP, deploy incoming resources and establish the incident organization.

Figure 3.7. The initial attack IC must develop the incident strategy based on the need for immediate structure defense or perimeter control to stop the fire before it reaches threatened structures.

Figure 3.8. Initial attack ICs must decide if the fire behavior warrants road closures and evacuations.

at scene. The initial attack IC should project positive command presence and controlled speech and emotions. Voice inflection and demeanor convey the sense of urgency commensurate with the situation.

Figure 3.9. If entire communities or large subdivisions are threatened, the IC must also initiate the evacuation of the threatened area.

This report contains vital information, including:

- Incident location
- Incident type
- Incident size
- Rate and direction of spread
- Wind speed and direction
- Fuel type
- Intensity or difficulty in control
- Threats to life, structures, and infrastructure
- Hazards or special considerations
- Access routes and the location of the ICP and staging areas
- Special instructions to incoming resources
- Incident potential

Tactical Worksheets

A tactical worksheet is a tracking document used to facilitate incident command and briefings. It provides a record of incident activity, assists the IC when completing incident command functions, facilitates situation status documentation and resource status tracking, and provides a medium for briefings and command transition. The initial attack IC initiates incident documentation on a tactical worksheet, such as an ICS Form 201 or similar document, as soon as possible.

When transitioning from initial attack to extended attack or from extended attack to a major fire organization, the tactical worksheet may be split up with one part going to the planning section and the other going to the operations section in order to facilitate strategic planning and document resource status.

Figure 3.10. When command transitions, the tactical worksheet initiated by the initial attack IC is crucial for establishing incident time lines and resource status. Form ICS 201 can be split with one section going to the operations section and the other to the planning section for resource accountability.

At a minimum, the tactical worksheet should include the following information

- Incident name
- Date prepared
- Time prepared
- Incident map
- Incident objectives
- Summary of actions or chronological log
- Current incident organization

- Resource summary
  - Resource ordered
  - Resource identification
  - ETA
  - At scene
  - Location and assignment

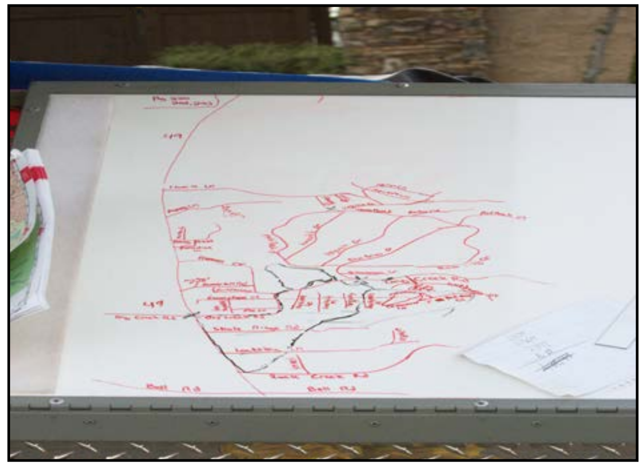


Figure 3.11. Incident documentation on a tactical worksheet includes a map of the fire perimeter showing roadways and waterways, and areas of special concern. The incident map can also be reproduced in a larger format for briefing incoming resources at the ICP.

Incident Map

An incident sketch map is an important tool for tracking incident progress and noting the location of incident overhead and resources. The map does not need not be precise or to scale, but should show an approximate footprint of the incident, branch and division breaks, the location of assigned resources, hazards, and values at risk. Include important landmarks such as roads, ridges, and major drainages that may be used as access routes, control lines, or decision points on the map. Using ICS symbology (located in the Field Operations Guide), the IC should identify portions of the fire perimeter that are uncontrolled, contained, or proposed as contingency lines, and the location of secondary lines, dozer lines, established drop points, and staging areas.

Summary/Chronological Log

A summary of incident actions or chronological log is similar to a diary and should document important incident information and actions taken. Chronological log notations should give a brief description of the event or action, what area or individual was affected by the action, and the time the event or action took place.

Organizational Chart

An incident organizational chart is an efficient way to account for incident resources and determine their location at a glance. An organizational chart also allows for expanding the incident organization in a logical manner.

Resource Summary

Resource accountability is one of the most important sections of the worksheet. ICs must know what resources are currently assigned to the incident, where those resources are located, and the nature of their assignments.

ICS designates three resource status categories:
- Assigned
- Available (staging or off shift)
- Out-of-service

ICs must keep track of the resources they have ordered and in what configuration they were ordered. Document both the estimated and the actual time of resource arrival at the scene.

Initial Attack Decisions and Actions

The Management Cycle

After completing the size up, the IC has to make numerous decisions. The Management Cycle is the foundation for the IC's decision-making process.

MANAGEMENT CYCLE	
PLAN	• Establish priorities: A priority is based on a predetermined assignment of value or importance as it relates to current events. • Determine objectives: Objectives are steps toward achieving a goal. Every strategy can be broken down into a series of objectives. • Formulate strategies: Strategies are the general plan or direction to accomplish incident objectives.
ORGANIZE	• Appropriate ICS structure to meet incident needs.
STAFF	• Assign resources by task and capability.
DIRECT	• Ensure that assignments are clear and understood.
CONTROL	• Establish feedback decision points or triggering events and timetables to ensure that assignments are carried out.
EVALUATE	• Is the plan working? • Are resources building line faster than the fire is spreading? • Are objectives being met?

Developing the Incident Plan

Developing an effective plan during the initial stages of any incident is quite possibly the IC's most important action. A plan is an organized sequence of events over a specified period of time to accomplish a goal. A plan ultimately establishes priorities leading to the formulation of strategies and tactics to meet objectives that are realistic, attainable, and prioritized.

Incident objectives are guidance and direction statements necessary for selecting appropriate strategies and the tactical direction of resources. Incident objectives are based on realistic expectations of what can be accomplished when all allocated resources have been effectively deployed. Incident objectives must be realistic, attainable, and measurable, yet flexible enough to allow for strategic and tactical alternatives. An incident plan includes both management objectives and control objectives.

Management objectives are general and list the priorities for life and property protection. Life threats include threats to firefighters and civilians alike. Structure defense objectives, costs commensurate with values at risk, and an assortment of environmental and political concerns typically round out the list of management objectives.

Control objectives outline what must be done to reach the ultimate goal of controlling the fire and include visible control points within which the fire will be contained (also known as the box).

"Keep the fire north of highway 299, east of Day Road, south of County Road 94 and west of Foothill

Road. Engage in structure defense and perimeter control actions concurrently."

Incident objectives should have the following "**SMART**" characteristics:

"SMART" CHARACTERISTICS	
Specific	Precise and unambiguous working to describe the objective.
Measurable	Objectives' design and statement should make it possible to conduct a final accounting as to whether or not objectives were achieved.
Achievable	Objectives must be achievable and describe expected accomplishments.
Realistic	Objectives must be achievable with the resources allocated to the incident, even though it may take several operational periods to accomplish them.
Time sensitive	Specify the time frame to accomplish the objectives (if applicable).

Figure 3.12. The initial attack IC should rely on personal observation and information gathering to develop the incident plan. ICs should also solicit intelligence from resources on the fire line and cooperating agencies such as law enforcement.

The incident plan will be influenced by the fire's history (what occurred between when the fire started and when the plan and objectives are developed); fuel, weather, and topography influencing the fire; and resources available to implement the plan. An IC should also solicit, digest, and use input from line resources and line supervisors. Air attack provides information on the fire: approximate size, rate and direction of spread, assets threatened in the path of the fire, access routes, and potential line locations. Communicating with air attack on the command frequency allows incoming resources to hear the conversation and get a better picture of the current fire situation and a better understanding of leaders intent and the developing plan.

Figure 3.13. The ATGS, with its aerial perspective, can communicate to the IC what the fire has done, what it's currently doing, and what will most likely happen in the near future. Strategic and tactical suggestions from the ATGS should be considered by the IC.

Equipped with intelligence and information,

Figure 3.14. If the fire has not reached any threatened structures, the IC should employ an aggressive, direct attack on the fire's perimeter in an effort to stop the fire's spread before it reaches the structures.

ICs must decide whether to employ an offensive strategy, a defensive strategy, or a combination of the two.

- An aggressive, offensive, direct attack on the fire perimeter may be the best course of action to stop the spread of the fire and eliminate the threat to life and property. This strategy is especially prudent if the fire has not reached the threatened structures.
- If the fire has already reached an area with structures, or fire impact is imminent, a defensive strategy may be needed to defend as many structures as possible.
- A combination attack is the preferred strategy when adequate resources are available. Take aggressive action on the fire perimeter while defending structures at the same time.

With the priorities, objectives, and strategy in place, the IC now has the beginnings of a workable incident plan.

Organizing the Incident

After developing a plan, organizing the incident is the next step to ensuring successful incident command. Early in the incident, the IC will perform numerous functions including command, planning, logistics, operations, safety, and public information.

- If there is no planning section chief on the incident, the IC develops the plan and accounts for resource status.
- The IC places orders for incident logistical support such as food, drinking water, hose, etc.
- Until the arrival of a public information officer, the IC fields questions from the media regarding incident status, potential evacuations, or structure loss.

To avoid becoming overwhelmed it is important for ICs to organize early and delegate.

Begin this process by determining the *span of control* necessary to accomplish incident objectives. Effective span of control is between three and seven resources per supervisor with five resources being the optimum. A rule of thumb is to divide incident resources by five to arrive at the number of line supervisors needed. As the incident increases in size and complexity, span of control increases as well.

> Span of Control
> The supervisory ratio of from three-to-seven individuals, with five-to-one being established as optimum.

The IC should establish divisions and/or branches as needed based on span of control.

Staffing the Incident

In some cases, the initial attack resources may be enough to implement the initial plan. After establishing the plan and organizational structure, the IC may need to order additional resources necessary to implement the plan.

Resource availability and reflex time are critical concerns. Resource availability is always determined by local, regional, statewide, and national fire activity.

Reflex time is the elapsed time between ordering the resource and when the resource is deployed on the fire line. Reflex time depends on how far the resource must travel to reach the incident, and in what configuration the resource is ordered. If resources must travel long distances to reach the incident, they may be delayed further by feeding and rest stops.

There are three ways to order resources: initial attack, immediate need, and planned need.

Initial Attack
- Usually a Code-3 response for protection of life and property
- Instantly or as quickly as possible
- Closest available resources should be utilized
- Resources ordered as strike teams or task forces should rendezvous at the incident

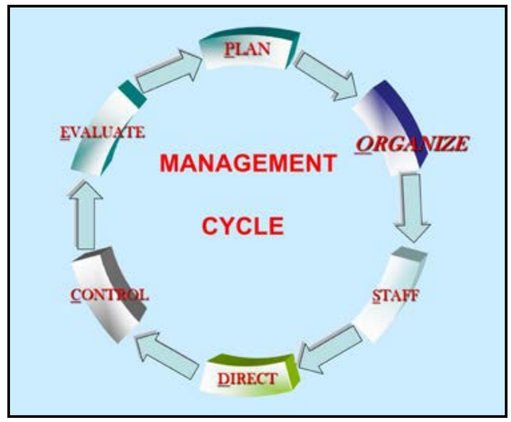


Figure 3.15. The Management cycle is not a linear process.

Immediate Need
- May or may not be a Code-3 response
- Resources respond immediately after dispatch
- Strike teams and task forces may or may not rendezvous prior to departure

Planned Need
- Normally not a Code-3 response
- Planned incident arrival time determines departure time
- Should be en route within one hour of request
- Strike teams and task forces will usually rendezvous before departure and travel together

ICs must consider the reflex time associated with each option when ordering resources. Ordering resources "immediate need, closest resource any type or kind" will get just that: any type or kind. Be prepared to form these unlike resources into taskforces to assist with supervision and span of control and by ordering taskforce leaders to supervise them.

Whenever possible, order resources that are capable of both structure defense and perimeter control action, allowing maximum resource flexibility as tactics change.

Make sure that the air tactical group supervisor (ATGS) is involved in the aircraft resource ordering process. The ATGS:
- Should know aircraft availability and will have fairly precise ETAs for planning purposes
- Will also have a good grasp of what type of aerial resources will best meet the objectives
- Must maintain communication with the IC on the status of all incident aircraft and the ordering and release of additional aircraft

At some point during the life of the incident, the IC will conclude that adequate resources are in place to successfully contain and control the incident. Resources for successive shifts are en route and accounted for or are off shift resting. If resources currently en route are no longer needed, they should be canceled as soon as possible.

Based on current and forecasted fire behavior and input from division supervisors or branch directors, the IC should scale down shift resources and release excess resources as soon as it is appropriate. Agency policy will dictate release priorities, but generally speaking, resources with the longest travel distances are usually the first to leave the incident. However, if another incident is in critical need of specific resources, those resources would have the priority for release from the current incident. Track all resource activity on a tactical worksheet.

Directing the Incident

ICs must direct incident activities and adjust the strategy and tactics based on what is or is not working.

Ensure that all incident resources understand the plan and the strategies and tactics being employed. Positive feedback from fire line overhead that all branch and division resources have been briefed on the plan is essential for effective teamwork and accountability. Ensure that safety and communication considerations are addressed. Make adjustments to the incident plan based on the intelligence gathered from air attack and line supervisors.

Figure 3.16. ICs and line overhead must utilize the standard briefing format to ensure that resources are adequately briefed prior to being deployed on the fire line.

At this point, the IC is directing the incident from an *incident command post* (ICP). WUI incidents are often commanded from a chief officer's vehicle located near the incident. The location of the command vehicle/ICP is very important. If the IC cannot observe the fire, it may be difficult to effectively position resources or determine if strategies and tactics are working. Avoid locating a mobile ICP too close to a staging area. Resources en route to the staging area are prone to bypassing the staging area and going directly the ICP, compromising resource accountability.

> Incident Command Post
> Location at which primary command functions are executed.

As an incident escalates, there may be a need to move the ICP into a structure that is safe and provides shelter, communications capabilities, and room to assemble. The location of both mobile and fixed ICPs should be accessible, visible, and formally announced, and not in the path of the expanding fire.

For large or extremely complex incidents, schools, fairgrounds, and other public facilities are an excellent choice for locating the ICP. These facilities generally allow for expansion of incident functions as the incident organization expands.

Figure 3.17. ICs must establish an ICP from which they will command the incident, communicate face to face with incoming resources, communicate by radio and phone to order and deploy resources, and document incident activities on a tactical worksheet.

ICs and fire line supervisors set the tone for the incident and communicate their expectations to assigned resources via an incident briefing.

Instructions should be direct and to the point and must be understood by the recipient. Ensure that recipients understood the information by having them repeat the information. Keep radio transmissions to a minimum in favor of direct contact.

The *Incident Response Pocket Guide* (IRPG) Briefing Checklist includes specific information that should be communicated during an incident briefing. For an example of the IRPG Briefing Checklist, see appendix p. A-2.

Figure 3.18. Large or complex incidents require larger ICPs and incident bases where more room is available, in particular for operational briefings.

Controlling the Incident

To put controls in place means to establish feedback, *decision points* or triggering events, and timetables to ensure that assignments are carried out. This enables the IC to evaluate the effectiveness, success or failure of a strategy or tactic, or the completion or inability to complete a task. To simply give instructions and not monitor the progress of the assignment is unacceptable.

For example: hand line must be constructed in Division A. The crew supervisor should provide a status report to the division supervisor at designated intervals regarding the crew's progress, problems associated with the assignment, and when the assignment is complete. Require line overhead to check back at predetermined intervals, when their assignment is complete, or if any problems arise that prevent them from completing their assignment.

High risk activities such as firing operations or downhill line construction may require even stricter controls.

Decision Point
A geographic point on the ground or a map, or a specific point in time where an escalation or alternative of management actions is warranted. May also be called trigger points or management action points. When the fire reaches a decision point, timely implementation of selected options is critical to successfully accomplish the incident objectives.

Evaluating the Plan

The most important element of the management cycle is evaluating the plan. Evaluating the success of the incident plan will dictate changes to objectives, strategy, and tactics affecting resource orders, logistical needs, and overhead support. If the current plan is not working, the plan must be changed.

There are numerous reasons for changing an incident plan including:
- Air and ground resources are diverted to a new incident, delayed, or are responding from long distances
- Dramatic weather changes increase fire behavior creating control problems
- Incident resources may lack WUI capabilities

The decision to change the incident plan should not be taken lightly. The IC must understand precisely why the original plan is not working and make changes accordingly. Intelligence from division supervisors and branch directors along with recommendations from the ATGS should be part of the decision-making process when changing the plan.

After creating a new plan, the IC must communicate it to all incident personnel. ICs must ensure that line supervisors pass the information on to their subordinates.

Figure 3.19. Before they are deployed to the fire line, all resources must be briefed when they arrive at the incident. Briefings are conducted at the ICP, which is often on the hood of the IC's vehicle.

Incident Briefings

An incident briefing is the best way to ensure that all suppression resources understand the incident objectives, strategies, and tactics. The briefing is especially important when new resources arrive at the incident and when resources move from one area of the incident to another.

Use the Incident Response Pocket Guide (IRPG) briefing checklist to ensure the briefing is as complete as possible:

Figure 3.20. The incident briefing should include map orientation and a discussion of the fuel, weather and topography affecting fire behavior and any problems hampering the suppression effort.
Photo courtesy of Kari Greer.

Incident Situation

The incident situation discussion should include the incident name, location, and map orientation. It should also include a discussion of other incidents in the area, especially any that could impact the current incident. The briefing should include a discussion of the fuel, weather, and topography influencing fire behavior, and must be specific to all elements of the fire environment. Highlight current and forecasted fire behavior and any extreme fire behavior events.

Mission and Execution

This is the opportunity to identify the IC and the incident organization including the immediate supervisors of the resources being briefed. Leader's intent statements should include the overall objectives and strategies for the incident and its end state. Discuss specific tactical assignments on an individual basis; which resources are going to which divisions and what their specific assignments are.

A detailed explanation of the assignment may be required to clarify tactical limitations or emphasize safety concerns. Discuss primary, alternate, contingency, and emergency plans and include locations for secondary control lines, safety zones, decision points, and tactical redeployment options. Also ensure that personnel know what appropriate actions may be used within leader's intent.

Communications

It is critical that all incident personnel understand incident command, tactical, and air–to-ground frequencies and that these frequencies are tested prior to deploying to specific assignments. The incident communications plan must include the medical plan and how incidents within the incident will be resolved. The IC and other fire line supervisors should emphasize the importance of using and monitoring only the frequencies assigned to the incident, and disallow the use of any unauthorized frequencies by incident personnel.

Resource Coordination

Incident personnel should be made aware of other resources working in the area and their assignment, especially if a firing operation is anticipated anywhere on the incident. Discuss protocols for aircraft use and clarify the chain of command for helicopter drops and fixed wing retardant drops.

Logistics

Logistical issues should include the location of fuel and other needs such as food, drinking water, and batteries etc. During an initial attack incident these functions will most likely not be in place however, if the incident transitions into extended attack or a *major incident*, logistics will become a critical concern.

Managing Risk

It is critical to discuss all known hazards and risks associated with the incident including forecasts of extreme weather events or extreme fire behavior, steep or unusually rocky terrain, drought conditions, anticipated control problems, and other hazardous conditions. Discuss safety mitigation measures for known hazards and establish the chain of command for any firing operations on the incident. Of particular importance are decision points that may determine whether or not the incident objectives remain the same or change to meet any new threats or conditions. For an example of the IRPG Risk Management Process, see appendix p. A-3.

Questions or Concerns

Ask for feedback from the briefed resources before they deploy. Check for body language. Do people look confused or lost? Are people talking among themselves and scratching their heads? Or are people confidently preparing for their assignment, directing their personnel to make ready? Ensure that everyone knows what's going on.

Unified Command

Unified command is a unified team effort which allows all agencies with jurisdictional responsibility for the incident, either geographical or functional, to manage an incident by establishing a common set of incident objectives and strategies in a common *incident action plan* (IAP), implemented by a single operations section chief. This is accomplished without losing or abdicating authority, responsibility, or accountability. Unified incident commanders must have the legal authority to represent their agency to authorize agency resource utilization and expend agency funds.

> Major Incident
> The fire cannot be contained within the first burning period, even with substantial augmentation of resources; long-term resource commitment and logistical support will be required.

> Unified Command
> A unified team effort which allows all agencies with jurisdictional responsibility for the incident, either geographical or functional, to manage an incident by establishing a common set of incident objectives and strategies in a common incident action plan (IAP), implemented by a single operations section chief. This is accomplished without losing or abdicating authority, responsibility, or accountability.

Unified command incorporates the following principles:

- One set of objectives for the entire incident
- A collective approach to developing strategies to achieve incident goals
- Improved information flow and coordination between all jurisdictions and agencies involved in the incident
- All agencies with responsibility for the incident have an understanding of one another's priorities and restrictions
- No agency's authority or legal requirements will be compromised or neglected
- Each agency is fully aware of the plans, actions and constraints of all others.
- The combined efforts of all agencies are optimized as they perform their respective assignments under a single IAP
- Duplicative efforts are reduced or eliminated, reducing cost and chances for frustration and conflict

Within a unified command, one person is selected as spokesperson for the groups. The spokesperson is usually the person representing the agency with the highest resource commitment or most visible activity. In some cases, this task may simply be assigned to the person with the most experience.

Incident Action Plan
Contains objectives reflecting the overall incident strategy and specific tactical actions and supporting information for the next operational period. The plan may be oral or written. When written, the plan may have a number of attachments, including: incident objectives, organization assignment list, division assignment, incident radio communication plan, medical plan, traffic plan, safety plan, and incident map.

Establish unified command if the incident threatens to cross or has crossed *direct protection area* (DPA) boundaries, or as outlined in unit operating plans where agreements between agencies provide for establishing unified command in certain situations. The IC should also consider unified command if the incident is within a *mutual threat zone* (MTZ) or *initial action zone* (IAZ) or if dictated by incident complexity and potential.

ICs should be aware of, and understand, the elements of any unified command agreements already in effect within their initial attack area. Although incident commanders may enter into a unified command agreement at the incident, the preferred method is a pre-established written agreement before an incident occurs. This is especially important on incidents where there may be competing priorities based on agency responsibilities.

Direct Protection Area
The area in which an agency has the financial responsibility for fire suppression.

In either case, when the incident transitions to unified command it is critical that the IC document and announce the transition time, unified IC's names, and any other provisions.

When entering into unified command, the IC from each jurisdictional agency should meet to:

- Identify jurisdictional/agency priorities and objectives
- Present jurisdictional limitations, concerns, and restrictions
- Develop a collective set of incident objectives
- Establish and agree on acceptable priorities
- Adopt an overall strategy or strategies to accomplish objectives
- Agree on the basic organization structure
- Designate the most qualified and acceptable operations section chief

Mutual Threat Zone or Initial Action Zone
A geographic area identified near the boundary of two or more separate jurisdictions that, through a predetermined agreement, receives a certain response from the agencies to protect their jurisdictions.

- Agree on general staff personnel designations and planning, logistical, and finance agreements and procedures
- Agree on the resource ordering process to be followed
- Agree on cost-sharing procedures
- Agree on public information release
- Designate one agency official to act as the unified command spokesperson
- Designate responsibility for incident-related activities (cause and origin investigation, accident investigation, evacuations, disaster declarations).

General Staff

When incident complexity reaches the point where the IC can no longer effectively manage all incident activities, the IC organizes the incident by delegating responsibility to different sections including operations, logistics, planning, and finance.

Operations Section

The IC should designate an *operations section chief* (OSC) to execute the incident action plan. The OSC manages the operations directly applicable to the primary incident objectives: ensuring the overall safety and welfare of operations section personnel. The OSC:

- Develops the operations portion of the IAP and completes the appropriate ICS Form 215 (Generic/Wildland specific) as appropriate.
- Briefs and assigns operations section personnel in accordance with IAP.
- Supervises operations section ensuring safety and welfare of all personnel.
- Determines need and requests additional resources.
- Reviews suggested list of resources to be released and initiates recommendation for release of resources.
- Assembles and disassembles strike teams and taskforces assigned to operations section.
- Reports information about special activities, events, and occurrences to IC.
- Maintains unit/activity log (ICS Form 214).

> Operations Section Chief
> The individual(s) responsible for overseeing the management of all operations directly applicable to the primary mission, ensuring the overall safety of all section personnel.

Based on incident complexity, the OSC may expand the incident organization. If two or three division supervisors are adequate for the size and complexity of the incident, and the prognosis for success is good, establishing branches may be unnecessary. If incident size and complexity are increasing exponentially and the prognosis for success is poor, the OSC should order branch directors and division supervisors.

Branch directors supervise divisions (and division supervisors) and report to the OSC. Branch directors may move resources within the branch between divisions to meet operational needs. Within the branches, division supervisors are responsible for all suppression actions within the geographical division including perimeter control and structure defense.

Integrating structure defense and perimeter control within geographical divisions or branches is a sound tactical decision that may reduce the IC's span of control while maintaining consistent incident objectives.

Organizing for Structure Defense

There are several options for organizing resources for structure defense. The key is simplicity. If a Division Supervisor can effectively supervise both perimeter control and structure defense operations within their division, they should do so. If the complexity of the structure defense operation requires additional supervision for span of control purposes there are several options to consider.

Structure Branch vs. Geographic Branch

Past practice on some WUI incidents was to assign a structure branch to supervise structure defense groups. This works well if all of the structures are located in one geographic area or the structure defense problem occurs in only one location at a time. This allows the structure branch to supervise the structure group(s), maintain situational awareness, and evaluate the effectiveness of the operation. However, if multiple structure groups are located in multiple divisions or branches, and structure defense operations are occurring simultaneously it is extremely difficult for the structure branch to maintain situational awareness and effectively supervise the groups.

The preferred method for CAL FIRE is to utilize the geographic branch director to supervise ALL operations in their respective geographic branch including perimeter control AND structure defense, supervise division supervisors and structure group supervisors within the branch.

Structure Defense Groups

Santa Barbara County Jesusita Fire - May 6, 2009

When Sundowner winds surfaced, the fire raced downhill into the city of Santa Barbara. When this occurred, the geographic branch director on the fireline ordered resources to disengage and move out of the path of the oncoming fire. At the same time, the structure branch director, located at the ICP, requested additional resources into the area to reinforce the structure group. This decision resulted in a burnover which caused firefighter injuries and damage to fire apparatus.

When a division supervisor is not able to effectively supervise both perimeter control and structure defense due to the size and complexity of the operation, or the resources exceed span of control, the OSC or geographic branch director may activate a structure defense group to perform structure defense tasks such as triage, structure prep, and structure defense tactical actions.

The structure defense group will work under the supervision of the geographic branch director and will need to work closely with the appropriate division supervisor to coordinate activities within the division. Remember, the best form of structure defense is to suppress the fire prior to the fire impacting the structures. This means that the structure group supervisor may need to support perimeter control as necessary to stop the fire before it impacts structures. Likewise, there may be instances where the division supervisor may need to supply resources to support structure defense.

Structure groups are designed to be a mobile force that can quickly deploy and re-deploy as needed into other divisions and branches. CAL FIRE recommends that groups be named for the incident and numbered in sequence. Example, on the Ponderosa Incident, a structure defense group would be designated as Ponderosa Structure Group 1 and might be assigned to Branch II. They would maintain this designator even if reassigned within the incident.

Figure 3.21. When new incidents or significant problem areas on an existing incident are a concern, staging areas should be established for strategic or tactical reserves, able to respond within three minutes of a request.

Some federal and local government agencies rely strictly on groups for structure defense. These agencies also name the groups by their geographic location rather than by the incident name and designator. Using the Ponderosa Incident as an example, the Manzanita Structure Group would be defending homes in the Manzanita sub-division. This same group when relocated to the community of Manton would become the Manton Structure Group.

Structure Defense Task Forces/Strike Teams

Another option for organizing structure defense operations is to utilize a structure defense *task force*. Task forces are made up of different kinds and types of resources and are formed for a specific task such as structure defense. Examples of structure defense task forces are discussed in more detail in chapter 6, Resource Utilization.

Engine *strike teams* can also be assigned to structure defense. A crew strike team could also be added to assist in structure prep thus forming a structure defense task force.

Staging Areas

The IC or OSC may choose to establish a *staging area* for effective incident command and control of resources. The staging area is a location where incident resources report to the incident, and from where they are assigned to a division or branch on a three-minute response status. Multiple staging areas may be required due to the size of the incident, travel complexities, or logistical needs.

The staging area manager (STAM) maintains control and accountability of all resources assigned to the staging area. The STAM should be a qualified person with good organizational skills. The STAM must have the command presence and experience to effectively control engine company officers and fire crew supervisors.

In the WUI environment, the number of responding resources may quickly overwhelm operations and command personnel. One solution is to assign

Taskforce
A group of unlike resources with common communications and a leader, formed at the incident or as part of a consolidated resource order for a specific task.

Strike Team
A specified combination of the same kind and type of resources, with common communications and a leader.

Staging Area
A location where incident resources report, and from where they are assigned and dispatched to a division or branch on a three minute response status.

an engine company to the staging area. The Company Office can serve as the STAM with firefighters to assist with resource check-in and status, logistical needs, and documentation.

The STAM should:
- Ensure that all staged resources are checked in (ICS Form 211) and ready to respond
- Monitor radio traffic including command, tactical and logistical frequencies
- Maintain accurate resource accountability at all times
- Identify lines of authority for ordering and assigning resources from the OSC
- Assign requested resources
- Request strategic reserve requirements from the OSC
- Continually update the IC or OSC on resource status and ordering

Staging Area Recommendations and Guidelines:
- Located away from the ICP (to avoid distractions) and out of the fire path
- Location available for an extended period of time, large enough to contain anticipated resources
- Capable of providing logistical support: drinks, feeding, sanitation, and security

Logistics Section

Suppression resources should arrive at the incident fully prepared for a 24-hour operational period. However, ICs should not forget the need for food, drinking water, and fuel, and should order enough to supply the incident for the duration of each operational period.

As the incident grows more complex, the IC should designate a *logistics section chief* (LSC) to manage and provide incident support and service functions.

Logistics Section Chief
The individual(s) responsible for overseeing all support and service responsibilities related to an incident.

Support	Service
Facilities (shower units, ICP, sleeping areas) Supplies (hose, hand tools, safety equipment) Ground Support (fuel, vehicle repair)	Communications (radios, radio repair) Medical (first aid, ambulance service) Food (meals, drinks)

Planning Section

As the incident grows more complex, the IC should designate a *planning section chief* (PSC) to take over incident planning responsibilities.

The PSC should:
- Prepare the IAP (Incident Action Plan for the next operational period.
- Maintain resource accountability and status (RESTAT)
- Maintain incident situation status (SITSTAT)
- Develop and update incident actions plans, demobilization plans, and contingency plans
- Maintain incident documentation
- Provide technical experts (fire behavior, weather, mapping)

Planning Section Chief
The individual(s) responsible for overseeing all planning responsibilities related to an incident.

Finance Section

As the incident grows more complex, the IC should designate a *finance section chief* (FSC) to oversee incident financial issues.

The FSC should:
- Track personnel and hired equipment time cards
- Track incident costs
- Provide cost apportionment services
- Process workers compensation claims
- Process personnel and equipment contracts
- Process incident damage claims
- Purchase equipment and supplies

Finance Section Chief
The individual(s) responsible for overseeing all financial responsibilities related to an incident.

Command Staff

The IC should order command staff as needed for any expanding or complex incident.

Public Information Officer

A *public information officer* (PIO) is responsible for developing and releasing information about the incident to the news media, to incident personnel, and to other appropriate agencies and organizations. Depending on the complexity of the incident, more than one PIO may be required to deal with the volume of inquiries or information dissemination.

Public Information Officer
The individual(s) responsible for developing and releasing information about the incident to news media, to incident personnel, and to other appropriate agencies and organizations.

Figure 3.22. The incident PIO helps to shield the IC from interruptions by the media during critical stages of the incident. The PIO can disseminate fire information approved by the IC to the media at scheduled press briefings.

The PIO should:
- Determine from the IC any limits on information release
- Develop material for use in media briefings
- Obtain IC approval of media releases
- Inform media and conduct media briefings
- Arrange for tours and other interviews or briefings as required
- Obtain media information that may be useful to incident planning
- Maintain current information summaries and/or displays on the incident
- Provide information on status of incident to assigned personnel
- Keep evacuees informed by providing information on incident status, status of evacuation orders and road closures

Liaison Officer

Multi-jurisdictional incidents and incidents with other agencies involved may require the IC to designate a *liaison officer* (LOFR). Each incident will

Liaison Officer
The individual who serves as the point of contact for the agency representatives assigned to the incident by assisting or cooperating agencies.

only have one lead LOFR and that person serves as the point of contact for the *agency representatives* (AREP) assigned to the incident by assisting or cooperating agencies.

Agency Representatives
Individuals assigned to an incident by an assisting or cooperating agency delegated with authority to make decisions on matters affecting that agency's participation in the incident.

The LOFR should:
- Be a contact point for AREPs
- Maintain a list of assisting and cooperating agencies and AREPs
- Assist in establishing and coordinating interagency contacts
- Keep agencies supporting the incident aware of incident status
- Monitor incident operations to identify current or potential inter-organizational problems
- Participate in planning meetings, providing current resource status, including limitations and capability of assisting agency resources
- Maintain unit/activity log (ICS Form 214)

Safety Officer

A *safety officer* (SOFR) may be necessary to address incident-related safety concerns and problems and provide solutions. The safety officer develops and recommends measures for personnel safety and assesses, anticipates, forecasts, or corrects hazardous or unsafe situations. The safety officer has the authority to stop or prevent unsafe situations, a responsibility that must be tempered with experience and common sense.


Figure 3.23. The safety officer should have a solid background in fire suppression strategies and tactics. A specific task or action, where safety concerns are identified, should be mitigated as soon as possible. Photo courtesy of Kari Greer.

Safety Officer
The individual responsible for developing and recommending personnel safety measures and assessing, anticipating, forecasting, or correcting hazardous or unsafe situations.

The SOFR should:
- Identify hazardous situations associated with the incident
- Review the IAP for safety implications
- Exercise emergency authority to stop or prevent unsafe acts
- Investigate accidents that have occurred within the incident area
- Conduct and prepare an Incident Safety Analysis (ICS Form 215-AG/AW)
- Initiate appropriate mitigation measures
- Develop and communicate an incident safety message as appropriate
- Review and approve the Medical Plan (ICS Form 206)
- Review and approve the Site Safety and Control Plan (ICS Form 208) as required
- Maintain unit/activity log (ICS Form 214)

Agency Representative

An assisting or cooperating agency may assign an agency representative (AREP) to an incident to assist with coordinating the agency's resources. An AREP has delegated authority from his or her agency to make decisions on matters affecting the agency's participation in the incident.

The AREP should:
- Ensure that agency resources are properly checked in and accounted for

- Provide input on the use of agency resources
- Cooperate with the IC on agency involvement on the incident
- Ensure the well being of agency personnel
- Advise the LOFR of any special agency needs
- Ensure agency reports are complete
- Debrief with the LOFR
- Maintain unit/activity log (ICS Form 214)

Additional Support Resources

Additional support resources may be required in order to maintain an effective span of control for the IC.

Additional Support Resources		
Position	**Role**	**Order When**
Crew Technical Specialist	• Provides technical expertise and knowledge related to inmate fire crews • Coordinates with AREP from California Department of Corrections and Rehabilitation (CDCR) to ensure that crews have proper logistical support and are properly used for tactical operations based on CDCR regulations	An abundance of fire crews and fire crew related issues threaten to overwhelm the IC
Hired Equipment Technical Specialist	• Provides technical expertise and knowledge related to hired equipment utilized on the fire line • Ensures supervision and provides briefings as necessary • Provides logistical support and contract management	The incident is using large numbers of hired resources, many of whom are civilians who do not understand the complexities of a rapidly escalating incident or the ICS organization
Resource Unit Leader/Check-in Recorder	• Tracks resource availability and assignments	The number of resources arriving at the incident compromises effective resource tracking
Field Observers	• Gathers and conveys intelligence and information • Prepares maps	Real-time fireline intelligence is necessary for incident related decisions

Incident Within the Incident

An incident within the incident may include a serious injury, burnover, shelter deployment, traffic or aircraft accident, or any other situation that requires immediate intervention and mitigation. Incident personnel should be prepared for an incident within the incident and have a contingency plan and organization in place to address any situation that may arise.

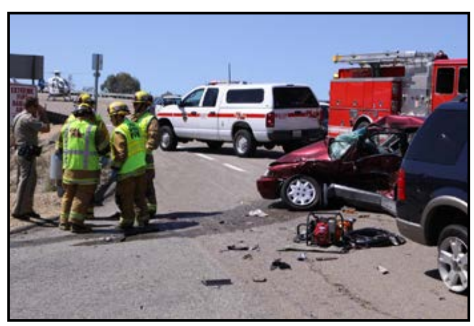


Figure 3.24. An incident within the incident may not always be fire related. Non-fire incidents must be dealt with by the IC who may appoint a division or group supervisor to command the new incident.

When an incident within an incident occurs, ICs should be prepared to appoint a supervisor to oversee all actions related to the event, such as a strike team leader, division/group supervisor, or line safety officer, etc. Additional tactical and command frequencies may be required for the new incident to avoid confusion and cluttered airways.

ICs must require a *personnel accountability report* (PAR) from the line supervisor in charge of the new incident as necessary to ensure that the incident is controlled and all personnel are safe and accounted for. Resources not assigned to the new incident must continue to engage the main fire.

Personnel Accountability Report
Periodic reports verifying the status of responders assigned to an incident.

Straylor Fire (Lassen County, CA) - July 2004

On the Straylor fire, a Type 3 helicopter was mapping the incident when it lost altitude and crashed just outside the fireline injuring three personnel. At the same time, the fire was beginning what would become a significant uphill run toward the crash site. Resources close to the accident were able to rescue the injured personnel and transport them to a timber landing as the fire impacted the area; however, there was still a threat from the fire. A Type 2 helicopter was able to land at the site and evacuate the injured to safety as resources were controlling the fire around the landing. Fortunately, a division supervisor was at the scene as the incident unfolded and provided leadership and accountability until the scene was secured.

TRANSITION ACTIVITIES

As dictated by a fire situation or agency policy, the initial attack IC may eventually transition command of an incident to a higher ranking officer.

Transition Briefing

For the most accurate information transfer, a formal transition briefing should be conducted face to face using the initial attack IC's tactical worksheet as the briefing's focal point. The initial attack IC's tactical worksheet compiles everything that has occurred on the incident since the arrival of the first units and must be passed on to successive incident commanders as the organization expands.

Figure 3.25. The best way to transition command of an incident is with a face to face meeting between the incoming and outgoing ICs.

The tactical worksheet is an important tool and helps the incoming IC visualize the current fire situation, resource locations, and incident organization as the outgoing IC describes it. The worksheet should be as complete as possible before the transfer.

The incoming IC should ask several key questions, including:

- What has happened?
- What is the plan?
- What needs to be done?

The outgoing IC must clearly articulate the current incident situation and priorities to the incoming IC, including the incident objectives as well as the strategies and tactics currently employed and whether or not they are succeeding.

Include accurate and specific resource status information including:
- Resources at scene (location and current assignment)
- Resources ordered
- Resources en route and their ETA

The outgoing IC should provide the incoming IC with the initial attack map showing the fire's progression, the location of incident resources, division and branch breaks, proposed control lines, and secondary lines. The map should also include notations of threatened structures, hazards, and special situations.

One of the final steps in the transition briefing will be to decide what role, if any, the outgoing IC will play in the ongoing incident. They may be reassigned, released, or placed off shift to rest. Depending on how long the outgoing IC maintained command, that individual may possess a wealth of knowledge about the incident. If the incident is continuing to expand, consider using the outgoing IC as the OSC or in another line overhead position. This will ensure consistent operational command and also relieves the incoming IC of the burden of excessive span of control. If the outgoing IC is an engine company officer, consider holding the engine at the ICP and utilizing its crew for expanded command functions such as scribes, resource status documentation, mapping, or as a staging area manager. As ordered command and general staff resources arrive, the engine can be reassigned to a division on the incident.

Figure 3.26. The incoming IC may want to hold onto the outgoing IC and the initial attack engine company functioning as the ICP. Personnel from the engine can perform such tasks as scribe, STAM, or in the case of the outgoing IC, a line supervisor or OSC.

Extended Attack Incident Command

A high priority for the *extended attack* IC is to evaluate the current incident plan. If the plan is working and the incident is well organized the plan should be left in place. If the plan is not working, or is reactive rather than proactive, then the extended attack IC must change the plan.

> Extended Attack
> A fire that is contained but not necessarily controlled during the first burning period with substantial resource augmentation. Extended attack implies that the complexity level of the incident will increase beyond the capabilities of initial attack incident command.

There may be a number of reasons why the current plan is not working:
- A significant change in the fuel, weather, or topography
- Resource availability and draw down
- A dependence on inexperienced or poorly trained resources
- Ordering the wrong resources for the required tactics
- Misusing resources
- Aircraft is unavailable to support ground resources

Any change in the plan must be communicated to all resources on the incident. The IC must receive positive confirmation from all branches and divisions that the new plan has been relayed to all incident resources.

Even after the IC confirms the existing plan or implements a new one, the IC must continue the size up evolution, gathering intelligence from line supervisors and air attack, monitoring the situation, and expanding the incident organization as needed.

The IC should start planning in advance for future operational periods, including:
- Meeting operational needs such as line overhead and staging areas
- Establishing a *strategic reserve* for problem areas on the incident
- Meeting logistical service and support needs such as feeding, drinking water, portable toilets, and fuel
- Formulating plans for a relief shift and ordering resources
- Developing, reviewing, and implementing contingency plans for structure defense and evacuations
- Organizing the day shift briefing including IAPs and accurate maps
- Re-ordering aircraft for the next operational period
- Requesting a spot weather forecast for the incident area

Strategic Reserve
A group of resources formed in anticipation of a new incident or the need to reinforce a critical situation.

Rule of Thumb when ordering resources:
- Place orders by 19:00
- Use current resource numbers as a starting point
- Adjust based on current and forecasted fire behavior

The best way to order for the day shift is to gather intelligence from divisions and branches using the *ICS Form 215*. The ICS 215 information should be as complete as possible for the following shift and should not only include the kind, type and number of resources requested, but the individual tasks for each resource, the reporting location for each resource, specialized tools or qualifications required and any other pertinent information the resource may need to ensure maximum efficiency during the operational period. For and example of the ICS Form 215W, see appendix p. A-4.

ICS Form 215
The Incident Command System's Operational Planning Worksheet fore wildland fires.

As the incident continues to expand in size and complexity, the IC will need to delegate tasks and responsibilities to other positions within the incident organization. Adding a public information officer (PIO) to the command staff allows the IC to remain focused on the incident, rather than become distracted by inquiries from the media and local citizens. Additional overhead to handle various functions such as plans, logistics, liaison, equipment time, and safety should be ordered before span of control issues overwhelm the IC.

Transition to an Incident Management Team

Eventually, the decision must be made whether to maintain the extended attack organization or transition to a major incident and order an *incident management team* (IMT). An IMT should be ordered at least 10-hours prior to the projected transition time.

Incident Management Team
The incident commander and appropriate general and command staff personnel assigned to an incident.

The decision to order an IMT is based on numerous factors:
- Incident complexity and potential indicate a prolonged engagement

- Inability of the current organization to contain and control the incident
- Inability of the current organization to meet command, finance, planning, or logistical needs
- Resource status in the local jurisdiction cannot support the incident and other initial attack activity

The extended attack IC must continue to aggressively engage the fire while planning for the team transition. The IC should confirm that the current plan is still working and will be appropriate for the next operational period. If not, the plan should be changed to match the incident's changing dynamics. Decision points and triggering events must still be monitored. Contingency and evacuation plans should be implemented as needed. Perimeter control should remain the strategic priority, to eliminate the threat to structures.

Figure 3.27. When an incident management team is ordered, the extended attack IC must select an appropriate site for an expanded incident base addressing basic logistical needs.

It is the extended attack IC's responsibility to work with the unit duty chief or line officer to prepare for the transition to a major incident organization. If the IC has been proactive and the planning and logistics functions are in place, the transition should be relatively seamless.

An incident base should be identified and basic logistical needs addressed including sanitation, feeding, and assembly areas. Incident base locations should provide for safety, shelter, adequate room to expand, and communications.

The IC should prepare the incident action plan (IAP) for the first shift after team transition prior to the transition briefing. Detailed maps showing the fire perimeter with appropriate ICS symbology in an appropriate size and format must be available for the transition briefing. The maps should show critical infrastructure and population areas threatened by the fire as well as branch and division breaks.

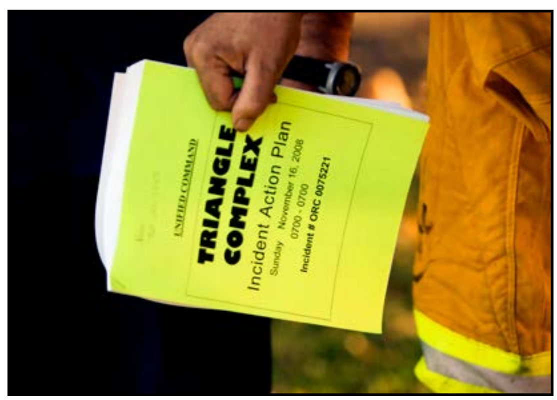


Figure 3.28. An Incident Action Plan should be produced in sufficient numbers for the first shift after the incident management team takes control of the incident.

All resources at the incident should be aware of the time when the transition of command to the IMT will occur. The extended attack IC should be present at the transition briefing to give a detailed update on the current situation and should appoint an interim IC, either the OSC or a branch director, to assume command of the incident during that time.

The transition briefing should include all of the information required by the CAL FIRE Incident Management Team Transition of Command document which can be found in the CAL FIRE Emergency Incident Management Handbook 7700, Section 7700 Exhibits. The web address is http://calfireweb.fire.ca.gov/library/#handbooks-7700. The transition briefing can also be found on the Incident Management Team website on the CAL FIRE Intranet.

POST-SUPPRESSION ACTIVITIES

Every fire is unique. Some can be suppressed quickly in the initial attack phase while others may burn for hours, days, or weeks. Some fires are suppressed with relatively few resources while others require a large organizational structure. Regardless of fire size or duration, every fire is eventually suppressed leaving fire service personnel with post-suppression responsibilities.

Incident Demobilization

The IC should release excess resources in a timely manner to reduce incident-related costs and free up resources for other incidents. On larger incidents, demobilization planning should begin well in advance of when demobilization actually takes place. The process of demobilizing resources generally begins at the operations section level, where the need for continued tactical resources will be determined. When tactical resources are no longer needed, the incident organization should be reduced.

Demobilization Roles and Responsibilities	
Role	**Responsibility**
Operations Section	Identifies operational resources that are, or will be, excess to the incident and prepares list for the demobilization unit leader
Planning Section	Develops and activates the demobilization plan
Logistics Section	Activates the transportation inspection program and handles special transport needs
Finance Section	Processes claims, time records, and incident costs, and assists in release priorities
IC	Approves resource release orders and demobilization plan

Release Priorities

In some cases, a release priority may be necessary if all resources are not processed for release at the same general time. Agency policy, work rules, and local, regional, or national guidelines may influence these priorities. The IC must also consider state and federal laws during demobilization planning. For example, large-vehicle drivers may be affected by laws related to the amount of rest required before the driver resumes travel.

This is the typical release priority for a CAL FIRE incident:
- Local government fire departments
- OES engines
- Federal military forces
- National Guard
- Hired personnel and equipment
- Other agencies (USFS, BLM, etc.)
- Out-of-region CAL FIRE resources
- Emergency fire fighter (EFF) crews

- Blue card or on call crews
- Within region CAL FIRE forces
- Unit CAL FIRE forces

Local conditions, economics, and the sending agencies' jurisdictional responsibilities may justify deviation from these guidelines. The IC is responsible for approving these deviations when they occur.

Damage Inspection

The IC is responsible for evaluating and documenting fire damage such as burned structures, damaged bridges, and damage to utilities and other critical infrastructure. The IC usually assembles one or more damage inspection teams for this task. Under the guidance of the planning section, fire-qualified personnel and other specialists document fire damage on all areas of the incident.

The damage inspection teams prepare a report documenting damaged and destroyed property and infrastructure and provide a financial loss estimate. Local agency needs generally dictate the scope and complexity of this report which is a valuable resource for local governments to use for disaster declarations, short and long term recovery planning, and tax appraisals.

Suppression Damage and Repair

The IC is also responsible for overseeing the inspection, documentation, and repair of damage caused by fire suppression activities. Suppression damage is damage that is directly related to or caused by fire suppression activity not by the fire and may include damage to:

- Fences
- Culverts
- Irrigation equipment
- Retaining walls
- Roads and bridges
- Waterways
- Structures
- Infrastructure (waterlines, septic tanks, gas lines, etc.)

On a simple fire, on-site resources can often perform the necessary repair activities. Large or complex fires require a suppression repair plan developed by fire suppression repair technical specialists. These individuals complete the assessments, document damages and locations on a suppression repair map, and request resources using the ICS Form 215.

Suppression repair is particularly important when the fire is large, damaging, politically sensitive, or where known environmental impact issues are present. Suppression repair planning should begin early and repair activities should begin as soon as operationally feasible, even during active suppression so that the repairs can be completed shortly after the fire is contained and controlled.

Suppression repair activities include:

- Rehabilitating fire lines, helispots, and safety zones
- Removing dirt and vegetation deposited in watercourses
- Repairing roads

- Removing trash and other debris
- Repairing fences, gates, and culverts
- Removing foams, gels, and retardants from private property such as homes, outbuildings, vehicles, etc.
- Notifying appropriate utility providers (power, gas, water) to restore services

Evacuee Re-population

The process of returning evacuees to their homes should be addressed early in the incident and include input from law enforcement and all agencies responsible for repairing infrastructure damage. Law enforcement plays a major role in the planning and execution process, controlling traffic flow, and allowing only legitimate residents back into affected areas.

The IC should develop a plan that addresses returning residents to their homes in a safe and timely manner.

Suppression resources must prepare for the return of displaced residents.

- Vital services such as power and water must be restored.
- Suppression damage that may pose a safety problem must be repaired.
- Snags and fire damaged trees must be stabilized or removed.
- Roadways must be cleared of fire damage, debris, and equipment.

Incident personnel must also be prepared for re-population. Increased traffic poses a significant

Figure 3.29. Incident personnel should prepare themselves mentally for civilian repopulation. Emotions can run high when civilians find their homes completely destroyed or, in some cases, the only home left standing.

safety risk to firefighters, especially when returning residents concentrate on fire damage rather than driving.

Incident personnel should continue to respond professionally when interacting with returning residents as emotions may run high and be unpredictable. Firefighters should engage any homeowner they see and offer assistance. The impression made by incident resources during this trying time will be a lasting one. Evacuee re-population is discussed in greater detail in chapter 8.

Administrative Activities

At the completion of operations and demobilization, the IC is responsible for many administrative activities including:

- Preparing the financial package that includes:
  - Workers compensation claims
  - Damage and repair claims
  - Time reports
  - Contracts
  - Facility use agreements
- Compiling reports (which may take months to complete)
  - Fire report
  - Fire investigation
  - After-action incident report
  - Accident report
  - Damage report
- Conducting closeout meetings with all involved agencies and organizations
- Participating in future audits or legal action if they occur

When the administrative responsibilities are complete, the incident finally terminates.

CHAPTER

4

STRUCTURE TRIAGE

The presence of civilians and structures in the WUI environment increases the complexity of a wildland incident. In addition to typical firefighting challenges, firefighters face unique problems in the WUI including evacuating civilians and animals; hazardous conditions such as propane tanks, power lines, and hazardous materials. In these situations, firefighters must rapidly assess a structure to determine whether or not it can be safely and successfully defended. This evaluation process is called structure triage.

STRUCTURE TRIAGE

Structure triage is the process of inspecting and classifying structures according to their defensibility or non-defensibility, based on fire behavior, location, construction, and adjacent fuels.

> Structure Triage
> The process of inspecting and classifying structures according to their defensibility or non-defensibility, based on fire behavior, location, construction, and adjacent fuels.

The decision to engage in structure defense should always be based on a determination that the structure is in fact defensible and that any risks to firefighters can be safely mitigated. Therefore, structure triage decisions must be based on current and forecasted fire behavior. Any change in fire behavior can quickly change the defensibility status of a structure.

When making a decision to defend a structure, firefighters must continually assess the fire environment as well as the physical features of the structure and its surroundings, and make a reasonable forecast of what will happen when the fire impacts the location. Accurate fire behavior forecasting is essential to effective structure triage and conducting safe structure defense operations. Firefighters have been

Figure 4.1. Triage means evaluating a threatened structure and, based on current and forecasted fire behavior, construction features and clearance, deciding whether or not the structure can be safely defended.

injured and killed during structure defense operations when fire behavior was underestimated.

Figure 4.2. Firefighters must evaluate the current fire behavior, fuel conditions, and construction features of the threatened structure to complete an accurate triage evaluation.

STRUCTURE TRIAGE CATEGORIES

During an incident, firefighters use the S-FACTS process (described below) to categorize structures as not threatened, threatened defensible, or threatened non-defensible.

Structure triage is a dynamic process and any change in the fire environment can quickly alter the defensibility of a given structure at any time. For example, a structure categorized as not threatened could be re-categorized as threatened defensible or threatened non-defensible based on a change in fire direction or intensity.

Strategies and tactics can also alter the defensibility of a structure. For example, if firefighters have time to adequately prepare a structure before the fire front arrives, the structure triage category for that particular structure could change from threatened non-defensible to threatened defensible.

> Tactical Patrol
> A continuous process of frequently rechecking structures, even those categorized as not threatened, to ensure the fire is completely suppressed.

> Prep and Defend
> Used when a structure is threatened but, based on forecasted fire behavior, clearance, and exterior constructions materials, it will be relatively safe to defend when the fire front arrives.

Not Threatened

A structure that is not threatened is either out of the path of the fire front or its construction and clearance characteristics are such that there is minimal threat, even if the fire front impacts the immediate area.

These structures have more than adequate flammable vegetation clearance and are constructed of fire-safe materials. They will require minimal resource time commitment and prep work and should be *a high priority for structure defense*. Homes whose owners have invested in proper clearance and fire resistive materials should be a priority when allocating scarce fire suppression resources.

Do not overlook or neglect not threatened structures, include them in *Tactical Patrol* or *Prep and Defend* tactical actions.

Figure 4.3. Structures not in the path of the fire with good clearance, a favorable topographical location and fire resistant construction features may be classified as not threatened.

Threatened Defensible

A threatened defensible structure has an adequate safety zone or temporary refuge area nearby, but there is a high probability that the structure will be damaged or destroyed without some intervention by suppression resources. Structures in this category typically have some degree of clearance from surrounding fuels and limited fire-safe construction features.

Fire department interventions may include removing fuels around the structure, closing windows, covering vents, and applying foams or gels. Intervention may require that fire department resources remain at the structure during the fire front impact. Residents are usually evacuated, but if they elect to stay, ensure they understand the situation and are prepared to shelter in place.

Figure 4.4. Structures may be classified as threatened defensible when a TRA or safety zone is present and when they exhibit fire resistant construction features and adequate vegetation clearance.

If there is not enough time to perform the necessary intervention measures or fire behavior changes adversely, structures classified as threatened defensible may be downgraded into the non-defensible category.

Threatened Non-Defensible

A threatened non-defensible structure does not have an adequate escape route to a safety zone, or does not have a temporary refuge area on site, and based on current and forecasted fire behavior, the structure cannot be safely defended.

Figure 4.5. Exercise caution when accessing mid-slope structure located in or near topographic features such as chimneys or saddles.

Structures in this category typically have little or no clearance from surrounding fuels and exhibit limited or no fire-safe construction features. The structure may be located mid-slope or in another dangerous topographical feature such as a chimney, saddle, or drainage. Evacuate civilians from structures that are classified as threatened non-defensible.

S-FACTS STRUCTURE TRIAGE CHECK LIST

During a WUI incident, it may be difficult to remember all of the factors that must be considered during the structure triage decision process. The Survival Facts, or S-FACTS, memory aid is a useful structure triage tool.

Use the three structure triage categories in concert with the S-FACTS memory aid in order to set priorities and make decisions about structure defense tactics and resource assignments. See Structure Defense Guide in appendix, P. A-29.

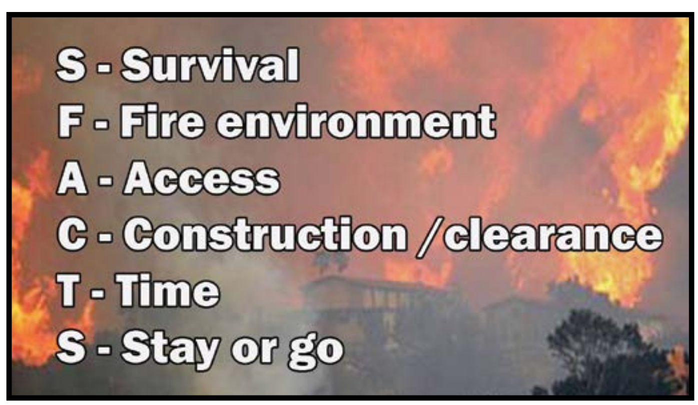


Figure 4.6. S-FACTS.

S – Survival

Firefighter safety is the top priority on any incident. If firefighters cannot survive in a location, they must relocate to a safer location.

Addressing firefighter safety is the first structure triage action. Use the following questions to determine whether or not a structure or location is safe or survivable.

1. Initial Assessment: Can you survive here? **If not, LEAVE NOW**
2. Is there a safety zone nearby? Can one be constructed near the structure? **If not, LEAVE NOW**
3. Is there a viable escape route? Can egress be improved to create one? **If not, LEAVE NOW**
4. Is there a *temporary refuge area* on site? Can one be constructed? **If not, LEAVE NOW**
5. What is the decision point at which you will leave based on fire behavior and rate of spread?
6. Is the *Prep and Go* tactic an option? **LEAVE BEFORE** escape routes are compromised.
7. Do you have communications with your supervisor and adjoining forces?
8. Can safety issues be mitigated? **If not, LEAVE NOW**

> Prep and Go
> Structure defense actions that can be safely completed prior to fire front impact where potential fire activity is too dangerous to remain and/or there is no Safety Zone/TRA present.

> Temporary Refuge Area
> A pre-planned area where firefighters can immediately take refuge for temporary shelter and short-term relief without using a fire shelter.

If there is any safety aspect that cannot be mitigated and resources cannot safely defend the structure, resource should leave the structure and move on to another assignment.

F – Fire Environment

Triage includes on site observations of current fire behavior and forecasts of what the fire may do in the near future. Evaluate the fuel, weather, and topographical features around the structure and estimate the intensity of the expected fire behavior.

1. Can you survive based on current and expected fire behavior? **If not, LEAVE NOW**
2. Look up, Look down, Look around indicators:
   - Fuel (characteristics, moisture, temperature)
   - Wind
   - Terrain
   - Atmospheric Stability
   - Fire Behavior (requires constant monitoring)

Figure 4.7. Initial triage assessment: Is the situation survivable?

Fuel

Fuel is the only fire behavior variable that firefighters can alter. What will the fire intensity be and how long will it take to consume the fuels? Evaluate the fuel around the structure, its relationship to the current weather and topography, and what measures firefighters can take to reduce the fuel load.

Figure 4.8. The evaluation of the fuel component in the WUI should include wildland fuels, ornamental vegetation, wood piles, propane and other fuel tanks, their proximity to the structure and the structure itself as part of the fuel load. Photo courtesy of Kari Greer.

The evaluation should include:

Fuel type

- What fuel type is carrying the fire front and contributing the greatest heat and ember production?
- Will fuel reduction efforts be easy or difficult (i.e. a grass model versus a brush model)?

Fuel loading

- How much fuel is present and how will that fuel load impact structure preparation timetables?
- Is there so much fuel that reduction efforts are impractical?
- Should fuel reduction efforts be focused on smaller areas around the structure, concentrating on the fire impact zone where at least some fuel may be removed?
- When vegetation is cut, can it be stacked or spread without creating large piles that contribute to the fire intensity problem?
- Can treating the fuels with gel or foam assist in reducing the fuels flammability?

Figure 4.9. What is the current fire behavior? What fuel is carrying the fire? How intense is the burn and how long will it take for the fuel to burn out? Are there indicators of extreme fire behavior such as area ignition or multiple large spot fires?

Fuel continuity

- Assess vertical and horizontal continuity and how it will impact structure preparation efforts.
- Evaluate vertical fuel ladders which will allow the fire to spread from the ground into the crowns of trees and large brush species.

Wind

- What is the current speed and direction?
- Are wind changes expected?

Terrain

- What is your position relative to topography?
- Are you in a chute, chimney, or saddle? **If yes, LEAVE NOW**
- Are you mid-slope or on top of a ridge?
- Is wind in alignment with topography?

Atmospheric Stability

- Is the atmosphere stable or unstable? Unstable atmospheres can lead to rapid fire growth.
- Are thunderstorms forecasted?

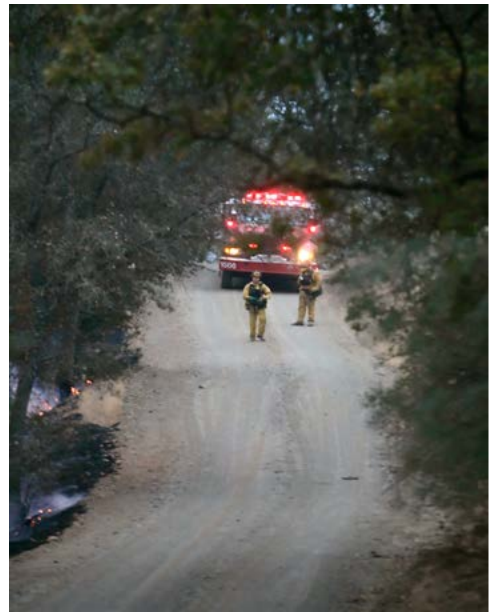


Figure 4.10. When the structure cannot be seen from the roadway, or when accessed at night, use scouts ahead of the engine to look for hazards.

Fire Behavior

- Is the fire spotting, crowning, or sheeting?
- What is the rate of spread?
- What is the current and forecasted flame length and height?

3. Other Weather Considerations
    - What is the current relative humidity?
    - Is there an expected change?

A – Access

Access to the structure must be safe for suppression resources to enter and exit the area. It must also allow enough time and distance to serve as an escape route to a safety zone or temporary refuge area.

Smaller engines such as type-3 or type-6 engines may be able to access a structure more easily than a type-1 engine or water tender. Resources should scout ahead before committing apparatus to specific locations.

1. Is the road surface adequate for the speed necessary?
2. Is the road an adequate width? If not, consider removing vegetation along the sides of the roadway, if time permits, to make access feasible for larger engines.
3. Are there appropriate turnarounds or turnouts? Resources may need to back into driveways under firefighter guidance so that they can pull forward out of a location that becomes inaccessible. If vehicles cannot pass one another, implement traffic control.
4. Are bridges within load limits for fire apparatus? Are bridges constructed of non-flammable material? If not, foam, gel or remove vegetation from around the bridge or post an engine at the bridge for fire protection.
5. Are there drainage ditches or culverts that could collapse or create obstacles for the apparatus?
6. Are road surfaces adequate for the road grade? If not, consider an alternate route to the structure. It is much easier to descend a steep grade than to ascend one.

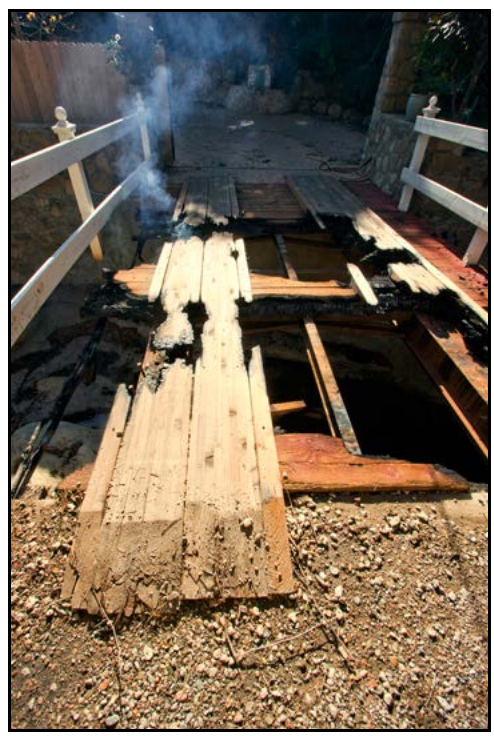


Figure 4.11. If bridges are constructed of flammable material, ensure they are secured with foam or gel pretreatment or post a firefighter at the bridge for exposure protection.

7. Is there a safe place to spot apparatus? Could the apparatus be safely used as a temporary refuge area? If so, there should be adequate clearance for anticipated fire behavior. Remove overhanging vegetation and avoid power lines, propane tanks, structures that may ignite, and saddles and chimneys.

8. Do resources have access to an adequate water supply (fire hydrant, pond, swimming pool, water tank) to defend the structure?

Figure 4.12. Flammable construction features such as shake siding or roofing, and ember traps such as open unprotected post and pier foundations are easily compromised when the fire impacts the structure.

C – Construction / Clearance

Evaluate the structure to determine how it was constructed and what materials were used.

1. Is the construction wood siding or shake/shingle? Have these materials been pre-treated with a fire retardant or not? If untreated, shake and shingle roofs will require foam or gel treatment. Untreated, these materials are far more flammable than non-combustible roofing or siding such as stucco, brick, or concrete. If wood or other combustible siding is present, the fire side of the structure may require treatment with foam or gel. Remove flammable debris from shake or shingle roofs and even composition roofs when possible. Most rain gutters contain flammable debris and must be cleaned or wetted down.

2. Are there vent openings, open eaves, or decks with vegetation below? Will ember intrusion through attic or foundation vents be a problem? Most residential structures have numerous ember traps such as gable end vents, foundation vents, decks and overhangs, and numerous nooks and crannies. Clean decks, especially underneath where leaves and needles accumulate. Cover vents if possible. If eaves are not boxed, evaluate the attic vent system and take measures to keep sparks or embers from entering the attic by this route.

Figure 4.13. Firefighters must evaluate ember traps such as gable end and foundation vents, where embers can enter and ignite a structure. Photo courtesy of Kari Greer.

3. Are there large glass windows facing the fire front? Windows facing the fire impact zone are a particular concern. Intense radiant heat directed through the window could ignite flammable material inside the structure, even without direct flame or ember impingement.

4. Is there access to the interior of the structure? Consider entering to close curtains and windows. Remember that structures may be used as temporary refuge areas, so leave doors unlocked.

Firefighters should also closely evaluate clearance around structures when making triage decisions.

Heavier fuels take longer to burn out than lighter fuels, requiring more mop-up and longer resource commitment time. It also takes longer to prep heavier fuels to provide adequate clearance for the expected fire behavior and fire front impact. Consider treating fuels with gels or foams rather than removing them if time is critical.

Figure 4.14. Melted window coverings and heat distorted video components are clear indicators of radiant heat intrusion through windows that could ignite interior construction components or furniture.

Triage efforts should focus on the fire impact zone with the goal of mitigating radiant and convective heat, as well as reducing ember production.

1. Does the structure have adequate defensible space, based on topography, fuels, and current and forecasted fire behavior?
2. Can defensible space problems be mitigated quickly?
3. Does yard clutter or the contents of the garage or outbuildings compromise safety? Outbuildings may contain hazardous materials.
4. Are there hazardous materials present? Should you write them off or protect them? Hazardous conditions, not generally considered structures, must also be triaged and catalogued for future defense preparation efforts.
5. Do propane tanks, fuel tanks, or power lines have adequate clearance?
6. Is the structure surrounded by non-native or ornamental vegetation? It may be just as flammable as native vegetation and should be gelled or foamed if it presents a defensible space problem.
7. Are the Prep and Go or Prep and Defend tactics an option?

T – Time Constraints

The final triage variable to consider is time.

1. How soon will the fire front impact the structure?
2. Is there enough time for an adequate size up of the structure defense problem?
3. Is there enough time to mitigate safety concerns?
4. Is there enough time and adequate resources to properly prepare and defend the structure before the fire front arrives?
5. Is there enough time to retreat to a safety zone if fire conditions change? **If not, LEAVE NOW**

Figure 4.15. Before the fire impacts the structure or compromises personnel safety, is there enough time to safely size up the structure and undertake appropriate defensive preparations?

S – Stay or Go

After considering all of the facts, categorize each structure as not threatened, threatened defensible, or threatened non-defensible.

Based on defensibility, choose a tactical action:

- Check and Go
- Prep and Go
- Prep and Defend
- Bump and Run
- Fire Front Following
- Anchor and Hold
- Connect the Dots
- Tactical Patrol

Tactical actions are discussed in greater detail in chapter 5.

Figure 4.16. Evaluate hazards such as power lines and poles, and propane and other above ground fuel tanks, their clearance and their proximity to the structure. Photo courtesy of Kari Greer.

Structure triage will help determine if resources are able to stay at a structure or if they will be forced to leave. Time is a critical factor during triage. At first glance, a structure may appear to be defensible with little or no intervention. Suppression resources must always remember that as fire behavior changes, the classification of a previously triaged structure may change as well, leaving no choice but to retreat to a safety zone or temporary refuge area.

TRIAGE DOCUMENTATION AND NOTIFICATIONS

After completing a triage evaluation of each structure, it is important to document and post the information, and pass the information on to appropriate personnel.

For example, an engine company officer should notify the strike team leader, who may pass the information on to the division supervisor. This information will help develop tactical priorities for structure defense operations and contribute to the overall incident documentation.

Figure 4.17. When completed after triaging a structure, the WUI Placard should be posted in a prominent location at the entrance to the driveway.

The plans and operations sections may also utilize this information to develop the Tactical Structure Defense Planning Worksheet for use later in the incident. Tactical structure defense planning is discussed in greater detail in chapter 9.

WUI Placard

The WUI placard, ICS Form 231, is both a safety tool and an aid for documenting structure triage observations during structure defense operations. Firefighters can use the placard to list pertinent structure-related facts and identify safety concerns to aid in the structure triage decision-making process. The WUI placard can be found at the FIRESCOPE website www.firescope.org.

The information is based on an assessment of the following: access, water supply, defensible space, and presence of occupants. It includes a signing system designed to quickly and easily communicate structure triage information to structure defense resources. Detailed instructions are printed on the reverse side of the placard. The placard will replace the various systems of flagging or marking of driveways with a standardized triage tool.

Firefighters should use the placard whenever time allows and its completion does not detract from critical suppression efforts. During initial attack there may not be adequate resources available to conduct structure triage.

Complete and place the placard in a visible location at the driveway or other access point to a structure. Attach the placard to a mailbox, fence post, or any item near the entrance to a structure. The placard will be very useful in areas where the structures are not readily visible from the roadway.

The placard does not categorize a structure as defensible or non-defensible. It captures an assessment of the environmental/structural conditions of the structure at a specific point in time. The date on the placard is critical because the information may not be valid at a later date or time. Firefighters should reevaluate the structure whenever there is a significant change in fire behavior or conditions, or resource availability. Record the new findings on a new placard. Place the new placard over the old one, or remove and discard the old placard.

Each section of the placard has a watermark to describe WUI triage criteria:

Access

- Is there good access for fire equipment? Access for Type 1 engines should be the minimum standard.
- Consider road width, surface, grade, and the availability of turnouts or turnarounds.
- Bridges and culverts must handle the weight of emergency vehicles.
- Use caution on mid-slope roads or when traversing drainages or chimneys.
- The access roads should not be overgrown with vegetation.
- Check for alternate ingress and egress routes.
- Circle the "A" if there is access and turnaround for a type-1 engine; place a circle with a diagonal slash through the "A" if there is not. Even if the "A" is slashed out, a type-3 or type-6 engine might still have access. Further evaluation is required for these types of resources.

Address

- Write in structure address(es) and street name.

Water Source

- Is there a water source for use by fire engines?
- Circle the "W" for yes; place a circle with a diagonal slash through the "W" for no. If yes, describe in the special notes or hazard section.

Defensible Space

- Has combustible vegetation been cleared a minimum of 100 feet away from structures (per California Public Resources Code 4291)?
- The proper clearance required to protect a structure is based on current and forecasted fire behavior and fire behavior may change during an operational period.
- Some topographic features and fire environment factors cannot be mitigated by structure defense resources. If adequate defensible space cannot be created with the available time and resources, the structure should be considered non-defensible.
- Circle "100 Feet" if yes; place a circle with a diagonal slash through "100 Feet" for no. If 100 feet clearance is present, but not adequate based on fire behavior, document inadequate clearance in the Special Notes section.

Civilians Present

- Are civilians present at the site?
- Circle the person icon if yes; place a circle with a diagonal slash through the person icon for no.
- If civilians choose not to evacuate, document non-compliance in the Special Notes section.

Special Notes and Hazards

- Place any special notes regarding the status of the structure in this box.
- This could include items such as additional or special mitigation measures needed, location of water supply, special hazards (propane tanks, hazardous materials, power lines), number of structures on site, or number of residents not evacuated, the presence of animals, or any other information structure defense resources should know to ensure their safety.

Date, Time, and Resource ID

- Write the full date, the time in 24-hour format, and the resource ID assigned to the incident.
- Example: 7/10/09 1645 SAC-E17

The example on the back of the structure assessment placard is for the lcation at 3246 Oak Street. The structure has adequate access and defensible space, no water source, and the residents have evacuated. The structure was evaluated by a single resource, SAC-E17, at 4:45 p.m. on July 10, 2009.

Firefighters must always consider current and forecasted fire behavior when completing the placard. While the placard is a valuable tool for structure triage, it does not replace continuous evaluation of fire environment conditions.

"The Structure Triage language contained in this guide is technical, i.e. the terminology describes tactical or operational actions or decisions. When communicating with the public or the media, the bottom line is that firefighters will risk lives to save lives. When it comes to structures, firefighters will take mitigated risk when and where appropriate. However, when faced with a choice of which home to defend and a limited number of resources, firefighters will choose to take a stand where they have a fighting chance to defend the home."

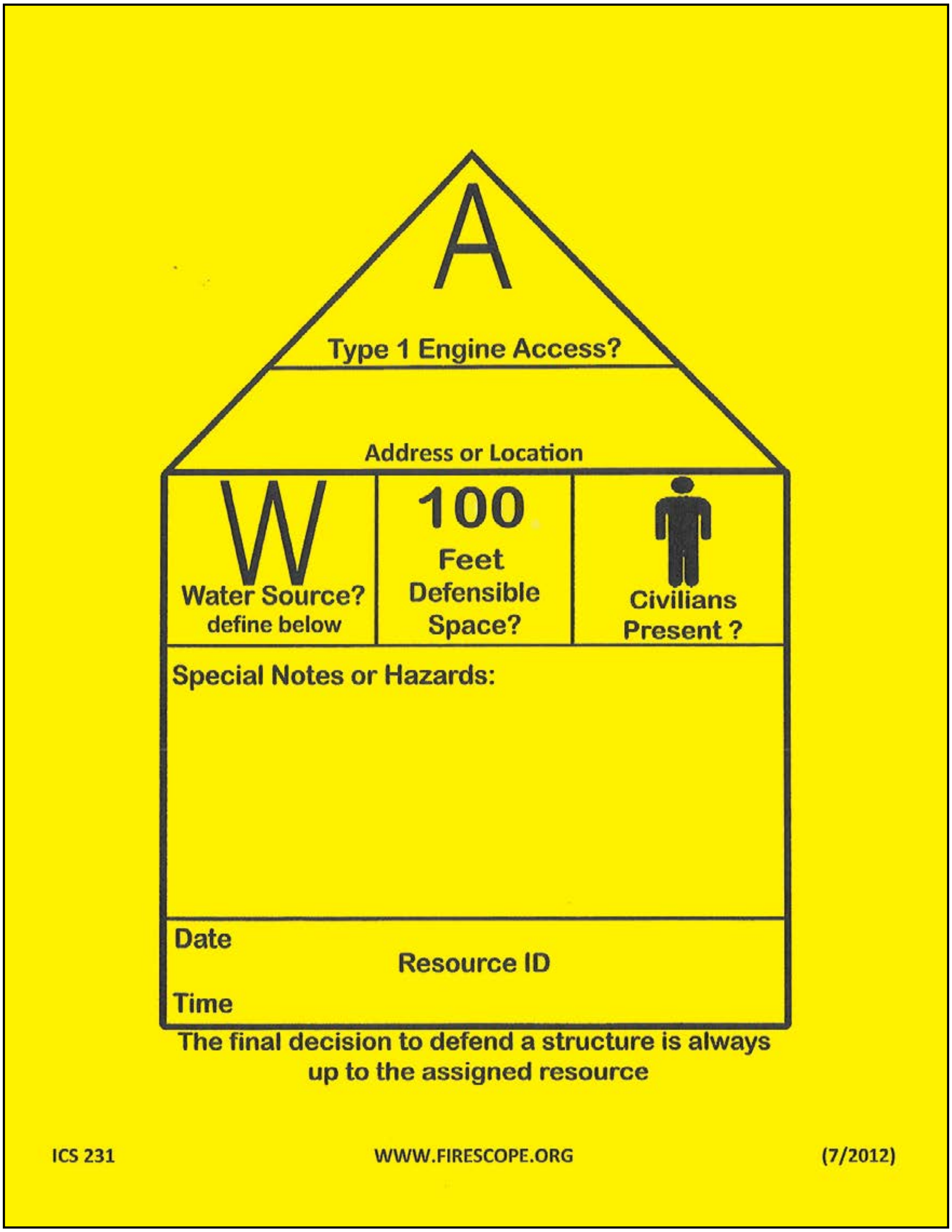
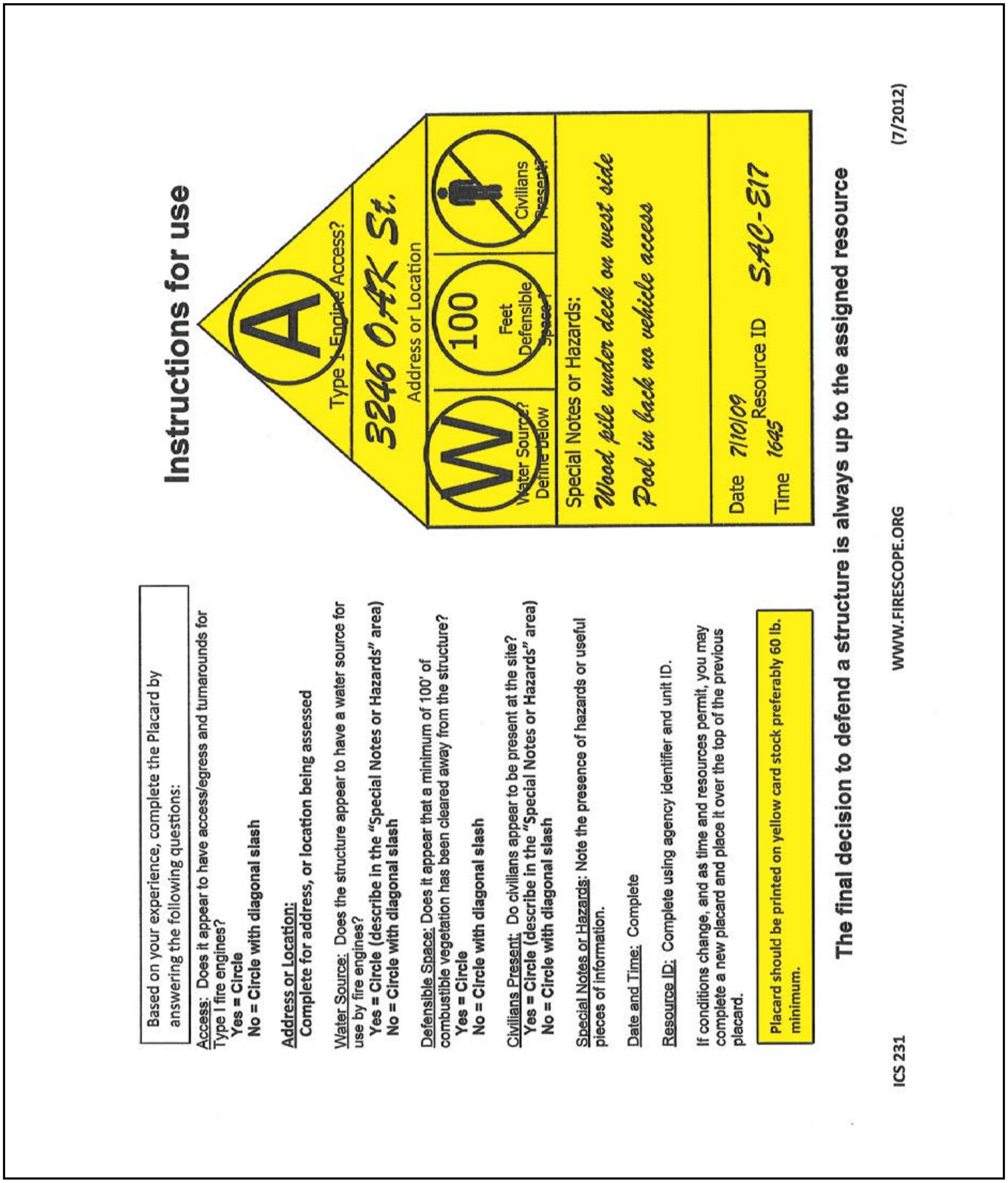


Figure 4.18. ICS 231 Front Image.



Based on your experience, complete the Placard by answering the following questions:

Access: Does it appear to have access/egress and turnarounds for Type I fire engines?
Yes = Circle
No = Circle with diagonal slash

Address or Location:
Complete for address, or location being assessed

Water Source: Does the structure appear to have a water source for use by fire engines?
Yes = Circle (describe in the "Special Notes or Hazards" area)
No = Circle with diagonal slash

Defensible Space: Does it appear that a minimum of 100' of combustible vegetation has been cleared away from the structure?
Yes = Circle
No = Circle with diagonal slash

Civilians Present: Do civilians appear to be present at the site?
Yes = Circle (describe in the "Special Notes or Hazards" area)
No = Circle with diagonal slash

Special Notes or Hazards: Note the presence of hazards or useful pieces of information.

Date and Time: Complete

Resource ID: Complete using agency identifier and unit ID.

If conditions change, and as time and resources permit, you may complete a new placard and place it over the top of the previous placard.

Placard should be printed on yellow card stock preferably 60 lb. minimum.

Instructions for use

The final decision to defend a structure is always up to the assigned resource

ICS 231 WWW.FIRESCOPE.ORG (7/2012)

Figure 4.19. ICS 231 Back Image.

CHAPTER

5

STRATEGY & TACTICS

Successful firefighting operations in the WUI are accomplished by developing sound strategies supported by effective tactical actions that keep firefighters safe, protect the public, and minimize property loss or damage. Suppressing the fire before it reaches threatened structures is often the most effective way to defend values at risk and must remain the focus of resources tasked with structure defense. Firefighters must understand tactical terminology, structure defense preparation tactics, firing methods and protocols, crew safety, and contingency planning in order to be safe and effective on any incident.

Figure 5.1. The best strategy for structure defense is to suppress the fire before it reaches threatened structures.

OBJECTIVES, STRATEGIES, AND TACTICS

Objectives: What needs to be accomplished

Incident objectives are guidance and direction statements necessary for the selection of appropriate strategy(ies), and the tactical direction of resources. They include both management and control objectives and are guided by three essential priorities: life safety, incident stabilization, and property preservation.

Incident objectives are based on realistic expectations of what can be accomplished when all allocated resources have been effectively deployed. Incident objectives should be specific, measurable, achievable, realistic, and time sensitive (SMART), yet flexible enough to allow for strategic and tactical alternatives. They should direct tactical activity toward a clearly defined, decisive, and attainable goal.

The Incident Commander (IC) will use the incident objectives to develop a general plan or strategy and will then deploy or direct resources to accomplish the objectives designated by that strategy.

SAMPLE OBJECTIVES	
Management Objectives	**Control Objectives**
• Firefighter and civilian safety • Structure and infrastructure defense • Keep suppression costs commensurate with values at risk • Protect sensitive environmental and cultural sites	• Keep fire north of County Road 6, east of Meadow Park, south of County Road 8, and west of the Parker Ridge

Strategy: What to do

A strategy describes the general method(s) that should be used either singly or in combination which will result in achieving the incident objective.

After the IC develops incident objectives, the IC or operations section chief (OSC), when assigned, must determine the appropriate strategy that is broad in scope and provides a realistic approach and direction for meeting the incident objectives.

Incident strategy must take into consideration the numbers and types of resources necessary to meet the incident objectives and the time required to put them in position. A strategy that requires a large number of resources to execute the plan will fail if the necessary resources cannot arrive in time.

Figure 5.2. Tactics must support the incident strategy. An offensive strategy requires direct firefighting tactics to stop the fire's spread and protect values at risk.

SAMPLE STRATEGIES	
Objective	**Strategy**
• Keep the fire north of County Road 6 • Keep the fire east of Meadow Park • Keep the fire south of County Road 8 • Keep the fire west of the Parker Ridge	• Offensive direct attack on the right flank • Defensive indirect attack on the left flank • Offensive direct attack on Parker Ridge • Defend homes along Parker Ridge Road

Incident strategy is also subject to change due to changes in weather, fire behavior, resource availability, or any other variable prompting a change to the incident objectives. For example, firefighters planning to execute a *burnout* from a road system a mile from the fire front may be forced to change to a direct perimeter control suppression strategy if cool, moist weather is forecasted to arrive before the burnout can be executed.

Burnout
Setting fire inside a control line to consume fuel between the edge of the fire and the control line, creating blackline.

Incident strategy must indicate whether an offensive, defensive, or combination attack will be used.

The IC or OSC should always consider an offensive strategy first. With an offensive strategy, suppression resources vigorously and aggressively attack the fire, often with multiple suppression tools, from multiple anchor points, using a variety of tactics. Firefighters using an offensive strategy will attempt to extinguish the fire perimeter before any serious impact to threatened structures can occur. Suppression resources are actively engaged in direct attack tactics on the edge of the fire with "one foot in the burn."

Use an offensive strategy when:
- There are ample resources to engage the fire at multiple points
- Fire behavior is such that control efforts at the fire's edge are safe and efficient
- The values at risk can be defended with a minimal resource commitment allowing most of the effort to be focused on the fire perimeter
- Resources are containing the fire faster than the fire is progressing

Figure 5.3. An offensive strategy means an aggressive attack from multiple anchor points using direct control tactics with one foot in the burn.

When an offensive strategy will not work, a defensive strategy may be necessary. A defensive strategy may focus solely on defending the values at risk while paying little attention to the fire perimeter.

Use a defensive strategy when:
- There is a lack of resources
- There is extreme fire behavior
- Conditions are unsafe for firefighters
- There is an immediate threat to life or property
- The terrain is such that control actions must occur some distance from the fire's edge

Figure 5.4. A defensive strategy focuses on indirect suppression tactics utilizing natural and man-made barriers away from the fire's edge usually followed up with a firing operation to create a black line.

A combination strategy utilizes both offensive and defensive strategies on different parts of the fire at the same time. Near the heel and flanks where the fire behavior is less intense, direct attack tactics may be used to aggressively attack the fire perimeter at multiple points. Near the shoulders and the head, resources may have to establish control lines using indirect tactics some distance from the fire.

Figure 5.5. A defensive strategy can be used when structures are immediately threatened at the head of the fire. An offensive strategy can be used to contain the flanks before the fire threatens any more structures.

Tactics: How to do it

Where strategy gives firefighters a general plan designed to accomplish incident objectives, *tactics* focus on the specific actions firefighters will take on the fire ground. The choice of which tactic to use can come in the form of direction from the IC or the OSC or it may be a decision made by the division or group supervisor or single resource supervisor.

When choosing a tactical action or when making a tactical plan it is very important to know what the fire behavior will be at the time firefighters engage the fire.

> Tactics
> Deploying and directing resources on an incident to accomplish the objectives designated by incident strategy.

Making an accurate fire behavior forecast in advance of the fires arrival is the wildland firefighter's greatest challenge. An accurate fire behavior forecast is difficult to make with absolute certainty, but it serves as the basis for determining if a tactical action will be effective and safe. Recognizing that there is always the potential for error in a fire behavior forecast requires having alternative actions (tactical maneuver) built into the plan. The key point is to never get locked into a single plan of action. Always have alternate plans.

SAMPLE TACTICS

Objective	Strategy	Tactics
Keep the fire north of County Road 6	Offensive direct attack on the right flank	• Air tankers and helicopters will drop water and retardant • Dozers will construct control line • Engine companies will conduct hose lays
Keep the fire east of Meadow Park	Offensive direct attack on the right flank	• Engine companies will mobile attack near Meadow Park
Keep the fire south of County Road 8	Defensive indirect attack on the left flank	• Construct indirect dozer line on ridge above County Road 8 • Prep line for firing operation
Keep the fire west of the Parker Ridge	Direct attack on Parker Ridge	• Construct dozer line on Parker Ridge • Follow up with engine company hose lays
	Defend homes along Parker Ridge Road	• Utilize Prep and Go and Prep and Defend tactical actions as applicable

SAFETY ZONES AND TEMPORARY REFUGE AREAS

To ensure personnel safety during WUI operations, firefighters must identify and evaluate escape routes, safety zones, temporary refuge areas, and potential shelter deployment zones before they are needed. Identifying these areas is a critical component of TACTICAL ENGAGEMENT. Consider the location and viability of these areas when developing a plan, conducting size up and structure triage, and choosing appropriate tactics for structure defense. Without an identified escape route, temporary refuge area, and safety zone, firefighters should not begin tactical engagement in an area.

Zone / Area	Description	Example
Escape Route	An identified route used to withdraw from a tactical work area to a pre-determined safety zone or temporary refuge area. The route should be clear of obstructions that could hinder a safe and hasty withdrawal. When escape routes deviate from a defined physical path, they should be clearly marked (flagged). As resources move within their tactical area, escape routes must be evaluated and reestablished as needed.	Existing routes: • Driveway • Sidewalk • Walking path • Constructed handline If no clear path exists, firefighters will need to cut and flag a path through vegetated areas along the most direct route to the safety zone.
Safety Zone	A pre-planned area of sufficient size and suitable location that is expected to protect personnel and equipment from known hazards without using fire shelters. The diameter of the safety zone should be a minimum four times the flame height. Extreme fire behavior conditions with heavy fuel loading or numerous burning structures may require larger safety zones.	• Any area without flammable vegetation (rock slide, bodies of water, wet meadows, cleared open space, greenbelts) • Large parking lots • School/athletic fields • Parks with open grass areas • Previously burned areas with no flammable canopy
Temporary Refuge Area	A pre-planned area where firefighters can immediately take refuge for **temporary shelter** and **short-term relief** without using a fire shelter. The purpose of the TRA is to have a predetermined rally point identified that firefighters can reach quickly and reassess their situation. Any time there is doubt about the safety of the crew, firefighters should abandon their TRA and immediately attempt to withdraw along their escape route to their safety zone. Utilizing a TRA requires another planned tactical action. For more information on TRAs see chapter 10.	• Large turnouts, cul-de-sacs, or parking lots • Lee side of structure • Inside structures • Inside apparatus • Greenbelts, meadows, pastures, large lawns
Shelter Deployment Zone	Deployment zones are areas where firefighters deploy fire shelters as a last resort to avoid injury or death. Use a shelter deployment zone when fire conditions compromise escape routes, temporary refuge areas, and safety zones. Shelter deployment zones are only used when there is no other alternative for survival.	• Avoid topographical features that funnel heat and smoke (chimneys, drainages, saddles) • Avoid heavy vegetation • Avoid snags • Avoid concentrated heat sources (burning structures, piles of debris) • Seek out flatter areas with minimal vegetation

TACTICAL ENGAGEMENT

Tactical Action

Effective tactical action operates on the core principle of agility. All tactical decisions are predicated on the idea that the selected tactics will be successful. The selected tactics must be capable of stopping the fire's advance or preventing the fire from damaging property and do so without injuring firefighters.

Situational awareness is the cornerstone of firefighter safety and survival and a key component of effective tactical action. Firefighters must be aware of what is happening around them and understand how information and events impact their tactical action, both now and in the future.

Figure 5.6. Tactics must support the incident strategy. An offensive strategy requires direct firefighting tactics to stop the fire's spread and protect values at risk.

Tactical Maneuver

Tactical maneuver builds agility into a tactical plan by allowing resources to work and move around in a hazardous environment without injury, while remaining effective. It encompasses both a thought process and movement or purposeful reaction to change. Tactical maneuver is most effective when potential changes to the primary plan have been identified and firefighters have an opportunity to plan out reactions to those changes.

Tactical planning must be developed in conjunction with anticipated changes in the fire environment, or fire behavior. Tactical maneuver (agility) is essential to ensure firefighter safety since legitimate safety zones are not always immediately present in the WUI environment.

Figure 5.7. When winds shift advantageously and fire spread moves away from threatened structures, resources must take advantage of the situation and change from structure defense mode to perimeter control mode.

Firefighters must be prepared to utilize tactical maneuver when changing from structure defense mode (defensive) to perimeter control mode (offensive) when fire behavior allows. It is imperative to take advantage of situations that allow firefighters to take perimeter control actions and suppress the fire.

Example 1: An engine company engaged in structure defense preparations at a structure notices there is a significant advantageous wind change. After realizing that the structure is no longer imminently threatened, the engine company engages and secures the fire perimeter near the structure.

Example 2: an engine company may go from one structure to another, moving with the fire, and be forced to take shelter in a safety zone, or use a structure as a TRA when threatened by extreme fire behavior or significant fire runs. They would return to full suppression mode again when the fire intensity subsides. This requires a continuous assessment of the fire and its potential.

P-A-C-E

For every tactical plan, an alternative or backup plan aimed at achieving the incident objective should be developed. In addition to having a backup plan to meet tactical objectives, there should be a backup safety or emergency plan for incident personnel.

Firefighters at the incident should start their structure defense planning by identifying an exit strategy. Firefighters must expect the unexpected and build agility and flexibility into their plan with contingency planning. The military acronym PACE, modified for fire service use, is an effective tool for developing tactical plans. PACE should be implemented prior to engaging in any structure defense plan.

Figure 5.8. ICs should use the PACE model to incorporate alternative plans into the overall incident strategy, and ensure that all incident personnel are aware of the alternate plans.

P: Primary Plan

A: Alternate Plan

C: Contingency Plan

E: Emergency Plan

P - Primary Plan (Offense)

The primary plan is the preferred plan which yields the best results and is focused on mission objectives and firefighter safety. The primary plan is the tactical action selected to address the current task or challenge. During structure defense, the line supervisor or engine company officer develops a fire behavior forecast then decides on the best tactical action that will have the least impact on property, such as a firing operation, hose lays, or pre-treatment with foam or gel.

A - Alternate Plan (Offense)

An alternate plan is a fallback plan that supports the primary plan. The results of an alternate plan may be less desirable than the primary plan and the risk to firefighters may increase. An alternate plan should be identified prior to fire front impact at a threatened structure in case the fire behavior exceeds the forecast and prevents implementation of the primary plan.

An alternate or backup plan allows resources to quickly and effectively refocus their efforts while continuing to work toward the incident objective. This substitute action may mean the loss of some values at risk but may save the bulk of those values in the long run. An alternate plan may require the use of a temporary refuge area if fire behavior dictates such action.

C - Contingency Plan (Defense)

A contingency plan is completely focused on firefighter safety. The plan may include withdrawal from active firefighting or a total change in the incident plan. The contingency plan is activated when fire behavior or other conditions exceeds the forecast and resources must withdraw from their position in order to avoid injury or entrapment. At this point the tactical objective to save property is abandoned and focus shifts to firefighter safety, which is accomplished by moving firefighting personnel into a temporary refuge area or safety zone.

Escape routes to a safety zone or a temporary refuge area are good examples of a contingency plan and are already a fire ground practice. Contingency plans are developed for numerous "What if?" situations such as spot fires, incidents within the incident, threats to subdivisions or communities, and evacuations.

E - Emergency Plan (Defense)

An emergency plan means firefighter survival is the immediate priority. When immediately threatened by fire, firefighters should move to their shelter deployment zone and deploy shelters. It is the responsibility of every firefighter to always have an identified shelter deployment zone and to deploy fire shelters in an appropriate location as a last resort.

It is critical that all personnel take responsibility for knowing how and when to execute the emergency plan. It is not uncommon during entrapments for the crew to become separated; communications are severed and personnel find themselves having to provide for their own individual safety. There should be a tailgate safety briefing between the company officer or crew leader and the crew about where the temporary refuges areas are, where the safety zones are, and what the decision points are for implementing the plan.

If situational awareness has been maintained, firefighters should not be surprised by an approaching fire front. However, there are unexpected situations that may trigger the decision to disengage and evacuate the area, take temporary shelter in an engine or structure, or deploy fire shelters in a deployment zone. Obviously, time and distance from the threat, or following escape routes to a safety zone are the preferred actions. If the decision is made to deploy fire shelters, do not wait until it's too late; if in doubt, deploy fire shelters quickly in a suitable deployment zone maintaining close contact among the crew and providing for personnel accountability.

PACE in Action

Engine Company

A Type 3 engine company is assigned to defend a structure in a residential area. After a thorough size up, the engine company officer decides that the structure is defensible and briefs the crew for the assignment.

The primary plan (P) is to use the Prep and Defend tactic to remove flammable debris from around the structure and prepare the structure for fire front impact by closing windows and doors and applying foam or gel to the fire impact side of the structure (this is also known as hardening the structure) and the surrounding vegetation. The engine will stay at the structure and actively engage the fire front when it arrives.

The alternate plan (A) developed is to use the Prep and Go tactic if the fire behavior changes adversely forcing the engine to withdraw to a safe location. The crew will harden the structure by applying foam or gel and removing flammable material from the fire impact side of the structure before leaving the area along an escape route.

The company officer also has a contingency plan (C) in the event firefighter safety is compromised at the structure. If conditions change dramatically and firefighters are immediately threatened, a temporary refuge area has been identified at the structure to avoid thermal injury. If conditions continue to deteriorate, the engine crew will simply return to their engine and leave the structure along an escape route putting time and distance between them and the threat.

As an emergency plan (E), the company officer has identified an area suitable for shelter deployment should the need arise.

Fire Crew

A fire crew is assigned to Division D. The fire crew supervisor has been briefed by the division supervisor and advised of shifting winds and periods of extreme fire behavior in the division.

The primary plan (P) is to begin constructing direct hand line anchored to a large safety zone. The crew will utilize the safety zone if needed and access will be back down the hand line they construct. If current conditions prevail the crew should be able to complete its task as planned.

The alternate plan (A), should conditions deteriorate and the crew can no longer construct control line at the fire's edge, is to change to an indirect attack strategy and move away from the fire's edge taking advantage of favorable topographic features and fuel beds while moving towards the designated finish point for their assignment. New escape routes and safety zones will be identified as the crew moves away from the original safety zone. The crew will be continuously guided by the 10 Standard Firefighting Orders and maintain LCES ensuring an early warning should conditions deteriorate further and the fire threatens to overrun their position.

Figure 5.9. Should the primary plan for the fire crew fail, an alternate plan, briefed prior to engagement, can be easily implemented.

A contingency plan (C) is also developed in the event the crew must abandon its position and return to its original starting point should the fire behavior become an immediate threat. The contingency plan calls for the crew to notify the division supervisor that they cannot hold their position and withdraw along their control line back to their starting point.

The crew supervisor also has an emergency plan (E) in place in the event the crew is trapped by the fire. An alternate escape route to a shelter deployment zone has been identified and relayed to the crew. This plan will only be used in the event of an immediate life threat to the crew.

TACTICAL ENGAGEMENT PRINCIPLES

The tactical engagement principles are guidelines that should be considered when developing tactical or strategic plans. A "principle" is defined as "a basic truth, law, or assumption," not a rule requiring strict adherence. It is possible to develop a plan and engage the fire successfully without addressing the tactical engagement principles. However, the tactical plan of action may not be as safe and certainly not as effective as it could be if the principles are applied during the planning process and the execution of the plan.

THE TACTICAL ENGAGEMENT PRINCIPLES	
Principle	**Description**
Objective	Tactical plans need Objectives to focus effort and clarify the mission.
Offense	Offensive action is necessary to achieve decisive results.
Mass	Sufficient firefighting power must be applied to prevail.
Reserves	Reserves provide flexibility, sustain power, and maintain momentum.
Maneuver	Tactical plans allow for tactical maneuver time to obtain position.
Security/Safety	Eliminating unnecessary risks is essential to successful tactical plans.
Position	Firefighting power should be applied to tactically advantageous points.
Simplicity	Direct, simple plans and clear, concise orders reduce misunderstanding

When using the tactical engagement principles it is assumed the firefighter :
- Is maintaining a state of heightened Situational Awareness
- Has completed and communicated a size-up report to the appropriate fire line supervisor or emergency command center
- Has completed an initial Risk Management Process as outlined in the Incident Response Pocket Guide

Tactical Engagement Principle #1
– The Principle of OBJECTIVE

Without objectives, tactical operations are reduced to a series of disconnected and unfocused actions. The purpose of the objective is to direct every operation toward a clearly defined, decisive, and attainable goal.

All operations on the fire ground are directed at clearly defined, measurable, decisive, and achievable objectives. Objectives focus efforts on the desired result or end state, keeping incident resources focused as a team working towards the same common goal. If properly expressed and relayed through a briefing, they help prevent independent action and unproductive effort. If assigned resources take actions that produce results counter to the objectives, they are futile, waste time, waste the resources' capabilities, and needlessly expose personnel to risks and hazards.

Figure 5.10. Incident objectives should be communicated to all suppression resources during formal operational briefings at the incident base or informally at the ICP prior to deployment to the fire line.

When faced with obstacles that preclude meeting incident objectives, ICs should establish Intermediate Tactical Objectives. Intermediate Tactical Objectives (ITOs) must contribute toward the overall tactical objective in terms of both speed and effectiveness. The purpose of ITOs is to break down the desired tactical objective into smaller, more easily attainable "mini-objectives" that if added together provide the same end-result of the original objective. While it can be said that the end state or"ultimate objective" is control of the fire, it usually takes attaining several Intermediate Tactical Objectives to successfully accomplish the "ultimate objective" of control.

Figure 5.11. ICs must brief their resources in order for those resources to understand the incident objectives and their role in the suppression effort.

When developing intermediate tactical objectives be careful to not arbitrarily develop so many that tracking them becomes a problem, or they become difficult or impossible to manage. Objectives should provide a framework for all actions on the incident.

ICs and fire line supervisors should not expect resources to automatically know what the incident objectives are if the objectives are not explained through a briefing. ICs have the duty and responsibility to brief their subordinates so they are aware of the incident objectives and their role in attaining them. If resources are taking action contrary to the objectives, or are not contributing to the overall effort, ICs have the responsibility to redirect those resources and get them working towards accomplishing the incident objectives

Tactical Engagement Principle #2 – The Principle of OFFENSE

A defensive posture should be only a temporary expedient until the means are available to resume the offensive. Even in the conduct of a defense, the IC should seek every opportunity to seize the initiative by offensive action.

In firefighting, offensive action is essential to achieve decisive results or turn the course of the incident. Incidents cannot be controlled from defensive tactics alone; only the resulting damage can be minimized. The wind driven WUI fires of southern California are excellent examples of the necessity of a defensive mode. There will be individual areas on the fire where offensive action is taken when the fire behavior subsides. However, during a majority of these wind driven fires, the extreme fire behavior forces resources to commit to defending structures in an effort to minimize the damage.

Figure 5.12. At some point during the incident an aggressive offensive action must take place in order to contain and control the fire.

Principle of Offense Discussion Points:

- Even if the capability of incident resources is overwhelmed by the fire's intensity, at an appropriate and precise point in time offensive action will be necessary to control the fire.
- Fireline supervisors should adopt a defensive mode only as a temporary measure and should

take advantage of every opportunity to switch to an offensive mode. Always look for a tactical advantage, an advantageous change in fire behavior or resource status, and have a plan ready when that advantage presents itself .

- Typically, both offensive and defensive actions are simultaneously occurring at different points on the same fire.
- Know the limitations of incident personnel and resources, their strengths and weaknesses. There is a time to engage and there is a time to wait for a better opportunity or a tactical advantage. Do not commit resources to an impossible or unsafe task just because "something needs to be done."

Aggressive offensive action should be taken only when there is sufficient firefighting capability immediately available, the fire behavior is within tactical limitations of the resources, and it is safe to do so. Always look for indications that the fire behavior has moderated in some area where offensive action would be appropriate.

Tactical Engagement Principle #3 – The Principle of MASS

The Principle Of Mass means that an "effective force" must be concentrated at the right time and place to obtain the desired results or maintain the offensive edge. The term "effective force" does not necessarily imply large numbers of resources, but rather resource capability and power. Effectiveness is achieved by synchronizing and integrating resources where they will have the greatest effect in the shortest amount of time.

Figure 5.13. An adequate number of the right kind and type of resources with the capability to effectively and aggressively engage the incident supports and maintains the offensive edge.

Synchronizing and integrating resource capabilities means using the strength of one resource to compensate for or enhance the capability of another resource. For example, use a dozer to construct control line in brush too heavy for a fire crew. Pair the fire crew with the dozer to clean up, burn out and hold the control line the dozer constructs. Another example is to utilize helicopter water drops to cool hot spots so a fire crew can work safely and effectively on the fire's edge.

Principle of Mass Discussion Points:

- Occasionally, the decision must be made whether to deploy a less than optimally effective force on both flanks of an incident or combine them and deploy one effective force on the priority flank.
- The Principle of Mass requires judicious use of resources and the acceptance of risk on the under staffed areas of the incident. Not staffing a portion of the fire requires the prioritization of the incident objectives and the acceptance

of the reality that under staffed portions of the incident may pose a problem later on.

- "Economy of Force" is part of the concept of Principle of Mass. The idea that if "one is good, two is better, and three must be even better" is not always true. Too many resources in one tactical area may become a safety issue if they all need to abandon the area at the same time. Capitalizing on a resource's capability must be the rule of thumb. Avoid the duplication of effort. Appropriate resources must be concentrated at the right place at the right time to achieve decisive results.

The Principle of Mass means deploying a force sufficient to make an effective attack that overpowers the strength of the fire safely with the minimum number of resources.

Tactical Engagement Principle #4 – The Principle of RESERVES

A strategic reserve is used to enhance the ability to engage the fire and to take action on unforeseen events, like a spot fire or new fire in the immediate vicinity.

Staging resources as a reserve may not be feasible during the early hours of an incident when every piece of equipment is critical for the suppression effort. With scarce resources, avoid forming a tactical or strategic reserve at the expense of the Principle of Mass. It would be better to have an effective force engaging the fire and no reserve, than a reserve force standing by while an ineffective force is struggling with the incident.

Figure 5.14. Strategic reserves should be staged close to the fire area near potential problem areas.

Principle of Reserves Discussion Points:

- Ensure the reserve resources are in a position to rapidly respond to the tactical objective they're called for. Any advantage they might provide would be lost if their reflex time exceeded the effective window of opportunity.
- Reserves should be employed to exploit success or sustain an attack, not to reinforce failure. Learn to recognize a losing battle and be prepared to disengage if necessary.
- Reserves should be committed in sufficient numbers to ensure success. They should be established as a task force or formed into a strike team if possible for maximum efficiency.
- When a reserve force is committed, a replacement reserve force should be ordered or designated. Consider the advantages of utilizing a reserve force for a night shift, when changes in weather and/or fire behavior may offer significant tactical advantages.

Tactical Engagement Principle #5 – The Principle of MANEUVER

The Principle of Maneuver describes the movement of resources to a strategic point where they can take advantage of an opportunity. Consider reflex time and the difficulty encountered to position the resources. This requires anticipating the resource need far enough in advance for a tactical maneuver to be planned, resource movement to occur, and resources to deploy on the fire line, all completed before losing the tactical advantage or before the fire gains the upper hand. For example, a strike team is assigned to defend a subdivision from an approaching fire front, there must be sufficient time to travel to the subdivision, triage the structures, set up for structure defense, and prepare for fire front impact. Underestimating the reflex time may strand the strike team in a dangerous position between the safety of the staging area and the relative safety of the subdivision.

Figure 5.15. Resources, especially staged resources, should be prepared to quickly relocate to any area of the fire where they might be needed.

Principle of Maneuver Discussion Points:

- What are the time constraints for completing the task? Consider reflex time to move resources into position, how long will it take for the resources to complete the task, how long will it take for them to secure their position?
- Are there adequate resources to accomplish that task within the time limit? Be realistic when estimating production rates, resource capabilities, and the time constraints.
- Consider resource limitations. Are roads adequate for the desired resources? Are there restrictions on bridges, road clearances, and maneuverability of the equipment? Are residents leaving the tactical area and blocking roads?

Tactical Engagement Principle #6 – The Principle of SECURITY and SAFETY

Safety as the number one priority should be the commitment of all firefighters who should promote as safe an operation as possible. The Principle of Security and Safety does not imply undue caution and risk aversion. It is impossible to avoid every risk because risk is equally common to both action and inaction. Security and Safety is achieved by establishing measures to protect personnel from undue risk. It is achieved by developing a tactical plan that avoids any unnecessary risks not related to the objectives. It is achieved by developing a tactical plan that recognizes and communicates the risks inherent in the operation to all firefighters to ensure they maintain Situational Awareness and utilize the Risk Management Process. Risk management is a fully integrated element of planning and executing incident objectives. Firefighters anticipate, identify, and assess new hazards in order to implement appropriate controls. Continually assess hazards such as fatigue, equipment serviceability, and the fire environment and identify areas where safety can be improved.

Figure 5.16. Fire line supervisors must ensure that the incident plan and objectives are known by all resources on the incident so that hazards and risks associated with the incident can be mitigated.
Photo courtesy of Kari Greer.

The Principle of Security and Safety ensures that the tactical plan is developed using the risk management process and other tools to maximize safety. Identify and assess the hazards each tactical objective, intermediate tactical objective, and tactical operation presents, identifying mitigating controls to eliminate any unnecessary risks.

Tactical Engagement Principle #7 – The Principle of POSITION

Tactical units must be in the correct position to act at the proper time.

The Principle of Position denotes where a firefighting force is applied, since it does no good to mass an effective force on a section of fire line that has burned itself out or holds no significant strategic value. Resource placement should be directly related to the tactical objectives. These positions are sometimes referred to as Decisive Tactical Points (DTPs). Engaging the fire at a DTP provides a significant tactical advantage.

Principle of Position Discussion Points:

- Prior to deploying resources, the capabilities of the personnel and equipment must be realistically considered. Attempting to place a two-wheel drive engine into an area where four-wheel drive is required creates an unsafe condition.
- Position is as important during defensive actions as it is during offensive actions. Defensive actions such as structure defense rely on resources positioning themselves in a safe location with appropriate safeguards such as escape routes, safety zones and TRAs while defending the structure.
- Resource limitations require the prioritization of the Decisive Tactical Points to maximize resource effectiveness.

Figure 5.17. Resources must be positioned for tactical advantage in areas of the fire where they will do the most good.

Tactical Engagement Principle #8 – The Principle of SIMPLICITY

The Principle of Simplicity means that simple plans and clear concise orders reduce misunderstanding and confusion. The simplest plan is the usually the easiest to implement.

When developing the tactical plan, avoid complicated or convoluted plans. Avoid plans that are difficult to explain. Keep the plan simple, use a standard briefing format and explain it in simple, concise language, ask for questions, and obtain feedback.

DRAW-D

There are five levels of engagement in firefighting easily recalled by using the acronym DRAW-D.

These actions apply to all aspects of wildland firefighting from the incident strategy to the individual line assignments and structure defense. They identify a thoughtful and mindful approach to choosing the appropriate tactical action.

D – Defend

These are holding actions, to protect priority areas and values at risk, holding and improving control lines and defending structures.

Figure 5.18. Defend – aggressive structure defense.

R – Reinforce

Bring in more resources to assist resources already engaged. Resources should be added to advance or hold ground.

Figure 5.19. Reinforce - reinforcements should be sent to areas of the fire where their capabilities will be advantageous to the suppression effort. Avoid using reinforcements in a futile effort.

A – Advance

Use aggressive tactics to move forward and gain ground such as anchor and flank by either direct or indirect attack. Consider limited firing operations to clean up indirect line.

Figure 5.20. Advance - gain and control ground with aggressive action such as firing in support of other offensive tactics.

W – Withdraw

Suppression actions should be curtailed until conditions become more favorable. Established positions may have to be abandoned. Withdraw to a TRA or along the escape route to the safety zone if conditions warrant.

Figure 5.21. Withdraw – resources should withdraw to TRAs or safety zones when conditions are extreme and suppression efforts are not effective.

D – Delay

It may be more prudent to wait in a safe area until the fire can be engaged under more advantageous conditions. For example, wait until more resources arrive; wait until the fire completes a sustained run or reaches a geographic area more conducive to ground attack.

Establish decision points to continue to advance and defend.

Delaying action is a conscious decision to maximize long term effectiveness.

Figure 5.22. Delay - a delaying action is not only prudent but safe in situations where fire behavior is extreme. Hold resources in a safe area where they can easily advance when fire behavior subsides.

Use of DRAW-D as Levels of Engagement incorporates a "can do" attitude in every level of engagement.

TACTICAL ACTIONS

Tactical terminology has been developed to create a common language that describes actions intended to put firefighter safety ahead of structure defense assessment. Because firefighter and civilian safety is always the first consideration, any tactical action should reflect that concern.

There are eight tactical actions used to defend structures in the WUI environment.

PRIMARY TACTICS	SECONDARY TACTICS
Check and Go	Bump and Run
Prep and Go	Fire Front Following
Prep and Defend	Anchor and Hold
	Connect the Dots
	Tactical Patrol

Primary tactics are geared toward defending a single structure. Primary tactics should also be used to ensure the correct and safe application of individual secondary tactics. The use of secondary tactics will change throughout the operational period as fire conditions dictate.

Use the Survival Facts (S-FACTS) memory aid (see chapter 4) to triage structures and help determine which tactical action is appropriate for each structure in a threatened area. Firefighters must consider the S-FACTS when determining which primary structure defense tactics may be safe and effective. For an example of the Structure Defense Guide , see appendix A page A-29.

Primary Structure Defense Tactics

The three primary tactics are used throughout the fire progression even as other secondary tactics are used. Suppression resources must still evaluate each individual structure and determine which one of the primary tactics will be used.

Check and Go

Check and Go is a rapid evaluation to check a structure for occupants who may require removal or rescue. In some instances, it may be necessary for firefighters to assist with evacuations prior to leaving. This tactic is appropriate when fire spread, intensity, lack of time, or inadequate defensible space prohibits resources from taking action to defend the structure.

Figure 5.23. The Check and Go tactic is especially prudent when fire impact is imminent.

Check and Go should be used when there is no safety zone or temporary refuge area available near the structure. It is a hasty evaluation due to expected fire behavior and fire impact time with the purpose of civilian life safety and a quick evaluation of the structure for follow up action after the fire front passes.

Resources should contact any occupants at the structure, advise them of any evacuation warnings or orders, and assist with potential evacuations if it is still safe to do so. Document any civilians who choose to stay at the structure and relay the information to a supervisor.

The most mobile resources should be assigned to Check and Go operations. Check and Go is not suitable for fire crews or dozers because of the need for mobility and rapid withdrawal from the structure site.

Prep and Go

Prep and Go is an appropriate tactic to use when it is not safe for resources to remain when the fire arrives, but there is enough time to safely complete some structure defense preparation before resources leave the area.

Figure 5.24. The Prep and Go tactic is ideal for the application of foam or gel when fire front impact is imminent or when there is so much vegetation around the structure that it cannot be adequately removed before fire front impact.

It is a quick strike maneuver where bare minimum tasks are quickly addressed by resources who may return after the fire front passes. Evaluate the structure for follow-up action when additional resources become available, the fire front passes, or fire behavior intensity has diminished.

Use Prep and Go when no safety zone or temporary refuge area is present or when fire spread and intensity are too dangerous to stay in the area when the fire front arrives. Prep and Go should be considered for defending structures in heavily vegetated areas with minimal clearance, structures upslope from the fire, and structures located in chimneys and saddles.

To prepare a structure for defense, firefighters should:

- Reduce or treat flammable vegetation from around the structure a distance of 100 feet, or an

appropriate distance, by using standard vegetation removal techniques or by applying foam or gel on both wildland and ornamental vegetation.
- Remove, reduce, or treat other flammable items (wood piles, patio furniture, decks, propane tanks, outbuildings, hazardous materials).
- Treat flammable building construction features (roof, siding, eaves) with foams or gels.
- Remove flammable materials from roofs and gutters.
- Cover vents if possible to keeps sparks and embers out of the structure.
- Consider entering the structure to close curtains and windows.
- Remember that structures may be used as temporary refuge areas, so leave doors unlocked.

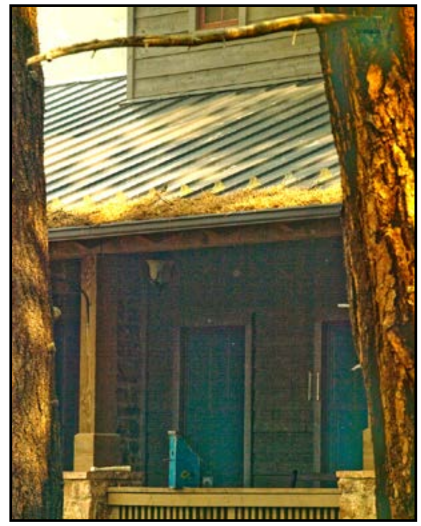


Figure 5.25. Metal roofs may appear to be fire resistant at first glance, however, firefighters must ensure that gutters and roof valleys are cleared of flammable debris. Photo courtesy of Kari Greer.

Depending on the situation and resource availability, structure prep time will vary and company officers should plan for a hasty retreat. When implementing the Prep and Go tactic, post lookouts and establish decision points to ensure adequate time for withdrawal.

Prep and Go is well suited for engine strike teams and taskforces. Strike team and taskforce leaders should familiarize themselves with the target area and sketch maps showing the location and address of structures. WUI pre-plans and maps, prepared prior to the incident by local agency personnel, should be distributed to strike team leaders and line supervisors to facilitate area orientation.

Resources should contact any occupants at the structure and advise them to evacuate if it is still safe to do so. Document any civilians who choose to stay at the structure and relay the information to a supervisor.

Once defensive preparations have been completed and depending on fire behavior, the structure's triage classification may have changed from threatened non-defensible to threatened defensible or not threatened requiring a different tactical action.

Figure 5.26. The Prep and Defend tactic is used when a TRA or safety zone is accessible and the structure can be safely defended.

Prep and Defend

Prep and Defend is an appropriate tactic to use when a structure is threatened but, based on forecasted fire behavior, it will be relatively safe to defend the structure when the fire front arrives. Use Prep and Defend when there is adequate time to safely prepare the structure for defense and there is ready access to a safety zone or temporary refuge area. Firefighters must maintain situational awareness and be prepared to move to the temporary refuge area or withdraw along the escape route to the safety zone when necessary.

Firefighters will both prepare the structure for defense (remove flammable vegetation, apply foams or gels) and stay on site to defend the structure during fire front impact . Firefighters will most likely engage in structure defense by utilizing direct attack on the fire edge and spot fires around the structure, or direct attack on the exterior of the structure. Firing operations may be necessary to eliminate fuel prior to the fire's arrival.

Prep and Defend is an ideal multiple resource tactic especially in neighborhoods containing small lots and homes close to each other. In these areas, numerous tasks may be coordinated at the same time over a wide area.

If the structure is deemed defensible, all safety concerns have been mitigated, and enough time exists to perform any structure preparation tasks, consider the following:

- Spot apparatus using the structure as a shield from radiant heat.
- Immediately select at least one temporary refuge area near the structure.
- Brief personnel on the structure defense plan and a safety contingency plan, discussing fire behavior and the tasks that must be completed prior to fire front impact.
- Deploy only as many hose lines as necessary for the forecasted fire behavior.
- Identify the engine protection line.
- Commence structure defense preparations and monitor the main fire.

Parcels with multiple structures or large structures might require additional resources to defend. If there is not enough time or resources to defend every threatened structure, prioritize the order of protection among the values at risk and order additional resources as needed.

Secondary Structure Defense Tactics

Secondary tactics are more specific and support the goals of the primary tactics. They generally require more resources, coordination, and supervision, and cover a wider operational area.

Bump and Run

Bump and run is a defensive tactic used when fire front impact is imminent or the fire is already burning structures and there are not enough resources to effectively take perimeter control action.

Figure 5.27. Bump and Run requires tactical mobility where resources are able to transition back and forth between structure defense and direct perimeter control.

When using the Bump and Run tactic, resources move at or near the fire front, often in the spotting zone ahead of the fire, to extinguish spot fires and hot spots, and to defend as many structures as possible. Bump and Run may be effective in the early stages of an incident when the resource commitment is light and structure defense is the priority. Resources should apply foam, gel or retardant to structures and surrounding vegetation as appropriate.

When Bump and Run is used on incidents with slow or moderate rates of spread and low flame lengths, resources conduct triage operations and suppress fire around structures using direct attack, and controlled firing methods to steer fire around the structure and/or eliminate fuels surrounding the structure prior to fire front impact. Check and Go, Prep and Go, Prep and Defend, and Fire Font Following tactical actions should be used as appropriate at each structure. Once a structure is secure and the threat has passed, resources re-deploy to another location ahead of the fire and repeat the process.

Figure 5.28. WUI hose brackets allow for the rapid deployment of hose during the Bump and Run tactic. The brackets allow for the secure stowing of the hose when the engine is ready to advance.

Bump and Run is well suited for Type 3 engine strike teams and taskforces. Engine strike teams and taskforces engaged in Bump and Run must understand the tactic and the mission. Engines should utilize WUI hose brackets for rapid deployment and re-deployment of hose. Establishing long hose lays is not part of the Bump and Run tactic. Suppression efforts should be limited to extinguishing spot fires, hot spots, and fire perimeter around structures and utilizing gels and foams to pretreat, assist in suppression and mop-up and then moving on to the next structure.

Resources that finish an assignment should leapfrog around engaged resources to keep the process moving. Close communication is essential to move Bump and Run resources in the desired direction and to monitor incident progress.

Dozers may be effective during Bump and Run actions. They can be used to control the perimeter, control large spot fires, construct fire breaks and control lines around structures, or enclose areas of multiple spot fires. Fire Crews are most effective assisting engine companies and assigned to perimeter control tasks.

When adequate resources are available, engine strike teams or task forces should be deployed behind Bump and Run resources to extinguish any spot fires and perimeter fire using the Fire Front Following tactic, Tactical Patrol, or reverting to direct attack perimeter control tactics.

Fire Front Following

The Fire Front Following defensive tactic allows resources to defend structures while staying *behind* the fire front or on the flanks of the fire, engaging after the fire front passes and fire intensity subsides. This fast-paced tactic requires engines to continuously move just behind the fire front in order to extinguish fires around structures before those fires can ignite the structure.

The main goal of Fire Front Following is to extinguish spot fires and hot spots burning around structures, extinguish partially involved structures when feasible, and to defend as many structures as possible from direct flame impingement and radiant heat. Resources can also conduct primary searches for civilians who did not evacuate and render aid if needed.

Fire Front Following is commonly used in conjunction with Check and Go, Prep and Go, and Bump and Run. Fire Front Following resources may re-check structures that were previously classified as Prep and Go or Check and Go during earlier structure triage.

Fire Front Following can also be used when there is insufficient time to safely set up ahead of the fire or the fire intensity would likely cause injury to personnel located at the fire front.

During the early stages of an incident, or when there are insufficient resources on an incident, single resource engines may use the Fire Front Following tactic to defend structures using mobile attack or hose lines. Engine strike teams and task forces may also be deployed to cover large geographic areas quickly. Fire crews can be very effective during Fire Front Following if the fire behavior and rate of spread are not extreme. Resources should utilize foams and gels to enhance knock down and mop-up efforts.

Depending on the terrain, dozers may be able to construct perimeter control lines; however, dozers may cause unnecessary destruction in and around structures.

Air tankers may not be effective due to poor visibility, concentrated groups of civilians and firefighters in the area, and numerous homes and other structures in the drop zones. Helicopters can be used for hot spotting around structures.

As with other defensive tactics, firefighters must maintain situational awareness and be prepared to switch to offensive strategies and tactics as soon as conditions change or sufficient resources arrive on scene. Fire Front Following may be followed up with resources assigned to Tactical Patrol to ensure no secondary structure ignitions.

Anchor and Hold

The goal of the Anchor and Hold tactic is to defend structures directly exposed to other burning structures or vegetation, extinguish structure fires, and reduce ember production in communities or subdivisions where fire spread is primarily structure to structure. Resources establish a control line, generally a street or roadway, and use large water streams in conjunction with fixed water supplies.

The Anchor and Hold tactic is more effective in urban neighborhoods where the fire is spreading from structure to structure. Anchor and Hold is often utilized in conjunction with the Bump and Run tactic. Bump and Run is used to extinguish spot fires down wind, while Anchor and Hold is used to prevent structure–to-structure ignition and ember production.

Establishing an Anchor and Hold line requires considerable planning and effort. Anchor and Hold is an excellent tactic for engine strike teams and taskforces. One engine from a strike team or taskforce must be committed to a dependable fixed water supply, either a hydrant or drafting source, and supply a hose line or supply line that covers the target area. Mobile engines from the strike team or taskforce engaged in individual structure defense actions or perimeter control are able to re-supply from this water source. The fixed engine must be spotted in a safe area and must not be threatened during fire front passage if the tactic fails.

Ground resources, such as engine companies and fire crews, should staff hose lines and be prepared to extinguish hot spots, fire perimeter, and involved structures. Direct action should be taken to defend exposures (structures or exposed vegetation) utilizing water curtains or direct water application using handlines or master streams, and foam or gel application if available. Direct attack on burning structures should be taken if necessary to reduce ember production and extinguish the fire. Mobile engines should be prepared to re-deploy to secondary control lines should the fire escape the Anchor and Hold line.

Figure 5.29. Anchor and Hold resources should consider using master stream devices to flow large volumes of water in an effort to defend exposures and to suppress fully involved structures thus reducing ember production.

Connect the Dots

Using the Connect the Dots tactical action, resources assigned to structure defense operations effectively stop forward fire spread at a particular structure or property. This area becomes a "dot" in the overall perimeter control effort. Connecting controlled portions of the fire perimeter, connecting one dot to another dot, is the foundation for this strategy. Connecting the controlled section of fire line at one structure, where the fire has been stopped, to a driveway or road where the fire is holding, can be an effective method to contain portions of the fire perimeter.

Figure 5.30. When using the Anchor and Hold tactic, resources may take suppression action on burning structures, even if fully involved, in an effort to reduce ember production and radiant heat transfer.

All structure defense operations should emphasize perimeter control as part of the structure defense plan; stopping fire spread significantly reduces the threat to structures. Resources assigned to structure defense should not only defend structures, but also take full advantage of perimeter control opportunities as they arise. It is unacceptable to simply defend a structure when there is also an opportunity for the same resources to control portions of the fire perimeter.

Using a combination of Connect the Dots and direct attack ("one foot in the burn") and indirect attack (using man made barriers such as ponds, canals, roads, and cultivated fields as part of the control line), resources can gradually connect sections of the fire perimeter to stop the fire's spread around structures.

Resources engaged in structure defense operations may also encounter numerous spot fires around a target structure. Unless completely overwhelmed by extreme fire behavior, resources defending structures should use Connect the Dots to take action on these spot fires, while simultaneously defending their assigned structure. Resources cannot confine their activities to only the structures and allow nearby spot fires to grow into larger fires, which in turn will threaten downwind personnel and additional structures.

Connect the Dots is an effective tactic to contain areas of multiple spots and connect those areas forming a contained perimeter. Firing operations should be a part of this tactic to create a "black line" when applicable.

Almost every type of firefighting resource should be considered for an assignment using Connect the Dots. Multiple single resource engines coordinated and supervised by the IC, operations section chief, or division supervisor, are as effective as a strike team or taskforce. Engine crews must pay close attention to their surroundings and be prepared to change tactics from structure defense to perimeter control. Communication between resources is critical to share intelligence on where the gaps in the perimeter line are located. Engines should use mobile attack and progressive hose lays; however, do not rule out forming engine companies into fire crews for hand line construction.

Figure 5.31. Dozers are an excellent tool to connect portions of secured control line, such as roads or driveways, to previously unsecured fire line when using the Connect the Dots tactic.

Fire crews are also well suited for the Connect the Dots tactic. Line supervisors should remember that fire crews, once deployed, are not easily re-deployed over long distances. Fire crews engaged in other structure defense tactics may easily change tactics to perimeter control, constructing hand line to connect areas of uncontrolled perimeter line to secured areas.

Figure 5.32. Helicopters can cool open sections of fire line and can provide direct support to engines, crews, and dozers engaged in the Connect the Dots tactic.

Dozers should be deployed to corral areas of multiple spot fires or connect open perimeter line to secured line over long distances. There is always the threat of damage to private property and infrastructure when dozers work in the WUI environment. Exercise caution to avoid damage without compromising safety and the control effort.

Fixed wing aircraft use may be limited depending on how much open line there is between areas of secured fire perimeter. Helicopters are better suited for this close-quarters tactic. Ground resources may need to communicate directly with helicopters to cool hot sections of line then move on to the next area of concern.

Tactical Patrol

Numerous structures in the WUI are destroyed after the main fire front passes and unseen smoldering or creeping fire ignites the structure. Initiate Tactical Patrol after the main fire front has passed and flames have subsided but when the threat to structures from smoldering or creeping fires remains. Use this tactic to extinguish hot spots or secondary structure ignitions, and address safety issues such as downed power lines, weakened trees, and other hazards. The key element of Tactical Patrol is to remain mobile and continuously monitor the tactical area while taking appropriate actions to defend structures and secure perimeter lines. Firefighters must remain vigilant to prevent structure re-ignition.

A Tactical Patrol should be assigned to areas exposed to downwind ember showers and areas where the fire has passed but the structures remain at risk. Vigilance and effective suppression actions must continue focusing on residual burning such as wood piles, lawn furniture, and secondary structure ignitions caused when wind stirs up embers in attics and eaves, under decks, and in other hidden locations. Identify and mitigate hazards such as islands of unburned vegetation, burning power poles, downed power lines, fire weakened trees, and rolling rocks.

Tactical Patrol is well suited for all types of taskforces and engine strike teams but especially Type 1 and Type 2 engine strike teams. Strike team/taskforce leaders should deploy their resources over a wide area and encourage personnel to quickly recon their assignment areas on foot. Extinguish hot spots and creeping fires immediately and monitor throughout the operational period. Resources should gain entry into any structure that may have been involved in the fire to ensure it is completely secured.

Fire crew strike teams should be deployed to grid the burned area and extinguish any hotspots they find. Fire crews should work in tandem with engines but should be encouraged to use backpack pumps as well as hose lines. Dozer strike teams are limited during tactical patrol operations but should be available for escape contingencies.

Figure 5.33. Utilize fire crews to grid and aggressively mop up burned areas to eliminate structure re-ignitions, extinguish creeping fire, and line unburned islands.

Figure 5.34. Tactical Patrol resources must focus on structures that sustained any degree of damage during fire front impact. These structures should be closely monitored throughout the operational period to avoid the possibility of re-ignition.

STRUCTURE DEFENSE CATEGORY	APPROPRIATE TACTICAL ACTIONS
Not Threatened	Prep and Defend Tactical Patrol
Threatened Defensible	Prep and Defend Bump and Run Anchor and Hold Connect the Dots Tactical Patrol
Threatened Non-defensible	Check and Go Prep and Go Fire Front Following Tactical Patrol

Tactical Combinations

With most WUI incidents, firefighters will use a combination of tactics in the same area of the fire on different structures at the same time. Resource capability and availability, the number of structures threatened, and fire behavior will ultimately determine which tactical combinations resources will use.

For example, fire breaks out on a five-house cul-de-sac on a ridge. An engine strike team is assigned to the subdivision. One structure is partially involved in fire so firefighters use Check and Go to assist occupants in a hasty evacuation. At another house, flames are already burning through the backyard and fire impact is imminent. Firefighters utilize Prep and Go by applying foam to the house and the vegetation surrounding it. At the third house, fire intensity is too great for firefighters to directly engage. They will need to utilize Fire Front Following after the main fire burns through. The fourth and fifth structures at the end of the cul-de-sac have adequate defensible space and there is enough time for firefighters to complete some preparation before the fire front arrives. They will use Prep and Defend on these structures.

Structure Fire Engagement in the WUI

Occasionally there is adequate time and resources to engage every structure on a WUI incident. However, on a rapidly expanding incident, resources may be unable to simultaneously engage in lengthy structure defense preparation and the suppression of structures significantly involved in the fire. There comes a point when resources must decide whether continuing to engage a burning structure contributes or detracts from the overall success of the incident. The resource must decide whether to engage the structure fire to the detriment of continued tactical actions or abandon the structure, possibly jeopardizing other control efforts in the immediate vicinity. Abandoning a burning structure will allow resources to focus their efforts where structure defense or perimeter control actions will be more effective.

Figure 5.35. Resources must decide whether engaging a burning structure takes precedence over moving on to a threatened structure. Should resources protect the threatened structure and let the involved structure burn or take action on the burning structure and possibly lose both?

Each incident is different and no clear rules or operating guidelines can be used to provide absolute direction regarding when to engage or not engage a burning structure.

Command and company officers need to evaluate resources availability, the number of structures burning, incident potential and the ramifications of abandoning or extinguishing burning structures and how it will affect incident success. For example, in some cases it may be more important to focus on perimeter control in order to reduce the threat to structures. In other cases, it is more important to focus on the burning structure because it may contribute to fire spread by producing embers and resulting spot fires.

RULES OF THUMB FOR STRUCTURE FIRE ENGAGEMENT IN THE WUI	
Situation	**Action**
Structure involvement is more than assigned resources can handle	Do not engage
No temporary refuge area for apparatus placement at the involved structure	Do not engage
Structure has multiple areas of fire involvement	Engage with caution
Less than 25% of roof involvement	Engage, disengage if a quick knockdown cannot be achieved
Fire confined to exterior siding	Engage
Burning outbuildings threatening other exposures	Engage with caution to defend exposures Determine the presence of hazardous materials

The decision to engage a partially-involved structure in the WUI is subjective. The bottom line is: Will the effort accomplish the goal of stopping the spread of the fire from structure to structure or eliminating ember production? Resources must evaluate the impact of a prolonged engagement with limited resources at the expense of continued perimeter control action or structure defense. If an involved structure cannot be extinguished safely and quickly with limited resources it must be abandoned.

Figure 5.36. Structures with minimal exterior or roof involvement should be engaged if knockdown can be achieved quickly.

Tactical Actions For Strike Teams and Task Forces

Generally speaking, when an incident exceeds the capability of the initial attack resources and enters the extended attack or major incident phase, reinforcement resources are ordered as strike teams or task forces. Strike teams and task forces are designed to reduce span of control and maximize the efficiency of a particular kind of resource or address a particular challenge associated with the incident. Strike teams and task forces allow ICs, line supervisors and strike team/task force leaders greater flexibility to engage the incident under the constraints of leader's intent. Tactical advantage is a major factor for effective strike team/task force deployment. No matter the resource or combination of resources, the strike team/task force leader should ensure that every resource has every tool it needs to ensure a safe, efficient and effective engagement.

Figure 5.37. When considering whether or not to engage a burning structure, company officers must carefully evaluate the extent of structure involvement, the proximity of the structure to exposures, and receptive fuel beds.

Strike Teams

Strike teams are usually composed of a specific number of engines, crews, or dozers of the same type. Tactics for strike teams are as varied as the resources themselves and, of course, depend largely on the fire situation and the assignment. When a fast moving fire impacts the WUI, there is generally a certain amount of controlled chaos as orders and directions are given, maps are consulted and fire behavior assessed prior to deploying the strike team.

In situations where roads are narrow or steep, citizens are evacuating the area posing a gridlock risk, or where thick smoke obscures vision to the point that individual structures cannot be plainly seen, strike team leaders should consider scouting the tactical work area prior to deploying individual strike team resources. The same is also true when assigned to an unfamiliar area or when deployed at night. This enables the strike team leader to determine that the area is safe and that the strike team resources will be able to negotiate the roads and driveways to access structures. It's always helpful for the strike team leader to have someone else in the vehicle to draw maps showing structure locations, street numbers and access points, and document pertinent information about resource locations, hazards and possible tactics.

Figure 5.38. Engine strike team leaders should consider scouting driveways and access roads when visibility is poor, the structure cannot be seen from the main roadway, or the strike team is engaged in night suppression action.

The strike team leader should take this opportunity to assess current fire behavior as well as develop a fire behavior forecast to determine a time line that will ultimately dictate the tactical options that may be used. Once the strike team leader is oriented to the tactical area and prevailing conditions, individual strike team resources can be deployed based on their capability.

Before deploying individual strike team resources, a briefing should be conducted where all relevant information is passed on including assignments, current and forecasted fire behavior, time line, location of safety zones and a contingency plan should the strike team need to mount a hasty withdrawal.

Strike teams need not be deployed in their entirety on every assignment. Strike team leaders may choose to hold a unit of the strike team back as a strategic reserve. For example, an engine strike team leader may deploy three engines holding two back for water shuttle: a crew strike team leader may hold one crew in reserve preparing a structure for defense while the other crew constructs perimeter control line. If the reserve crew is needed to support the control line construction effort they are readily available.

Check and Go

Engine strike team resources can easily saturate the tactical work area and check for occupants at multiple structures if fire impact is imminent. Resources should be instructed to enter driveways cautiously if the structure cannot be seen from the road using a scout if necessary. Once at the structure the engine should immediately be positioned pointed in the direction of travel to safety while crew members assess the area for occupants. Note the presence or absence of occupants on the WUI placard and be prepared to assist any occupants unable to evacuate on their own. Document any occupants who plan on staying at the structure during fire front impact and advise the STEN (strike team leader engine). When finished at one structure, complete the WUI placard and post it at an obvious location at the entrance to the driveway, then move on to the next structure leapfrogging around other engaged resources.

The Check and Go tactic is not advised for fire crew or dozer strike teams that usually require significant time to deploy then re-deploy placing them at risk during this fast moving fire scenario.

Prep and Go

As with Check and Go, engine strike team resources can saturate an area to perform triage and structure defense preparation tasks quickly, moving to another structure if time allows again leapfrogging around other engaged units. After entering the immediate structure area, re-positioning the engine for a hasty withdrawal, and posting a lookout, the engine crew should utilize the S-FACTS tool to assist with structure triage.

When these questions are answered, structure defense preparation tasks should be identified, prioritized and addressed concentrating on the fire impact side of the structure. Foam and gel application should be considered the most expedient way to prepare a structure for fire front impact. If time allows, fuel concentrations can be dispersed and exposures such as lawn furniture can be moved to the lee side of the structure. Basic hardening tasks should be completed if time allows. When the preparations are complete, the engine should leapfrog around other engaged units from the strike team and move to another structure advising the strike team leader of their progress and new location. A WUI placard should be posted in a conspicuous place at the end of the driveway before the resource leaves the prepared structure.

Prep and Go is an appropriate tactic for fire crew and dozer strike teams as well, as long as these resources are able to return to their transportation and redeploy or move to a safety zone in a timely manner. Fire crews can quickly perform numerous structure defense preparation tasks at the same time, especially time consuming tasks such as fuel reduction, Both fire crews and dozers can construct control lines around threatened structures in an effort to stop the fire's spread before it reaches the structure.

Figure 5.39. In a Prep and Go situation, resources should concentrate on the fire impact side of the structure by removing or gelling/foaming concentrations of fuel. Photo courtesy of Kari Greer.

Prep and Defend

Individual engine strike team resources should be assigned structures based on structure density in the area and forecasted fire behavior. In areas of dense structure arrangement, one engine may be able to defend 2 or 3 structures depending on the fire behavior. In areas of sparse structure placement it may be

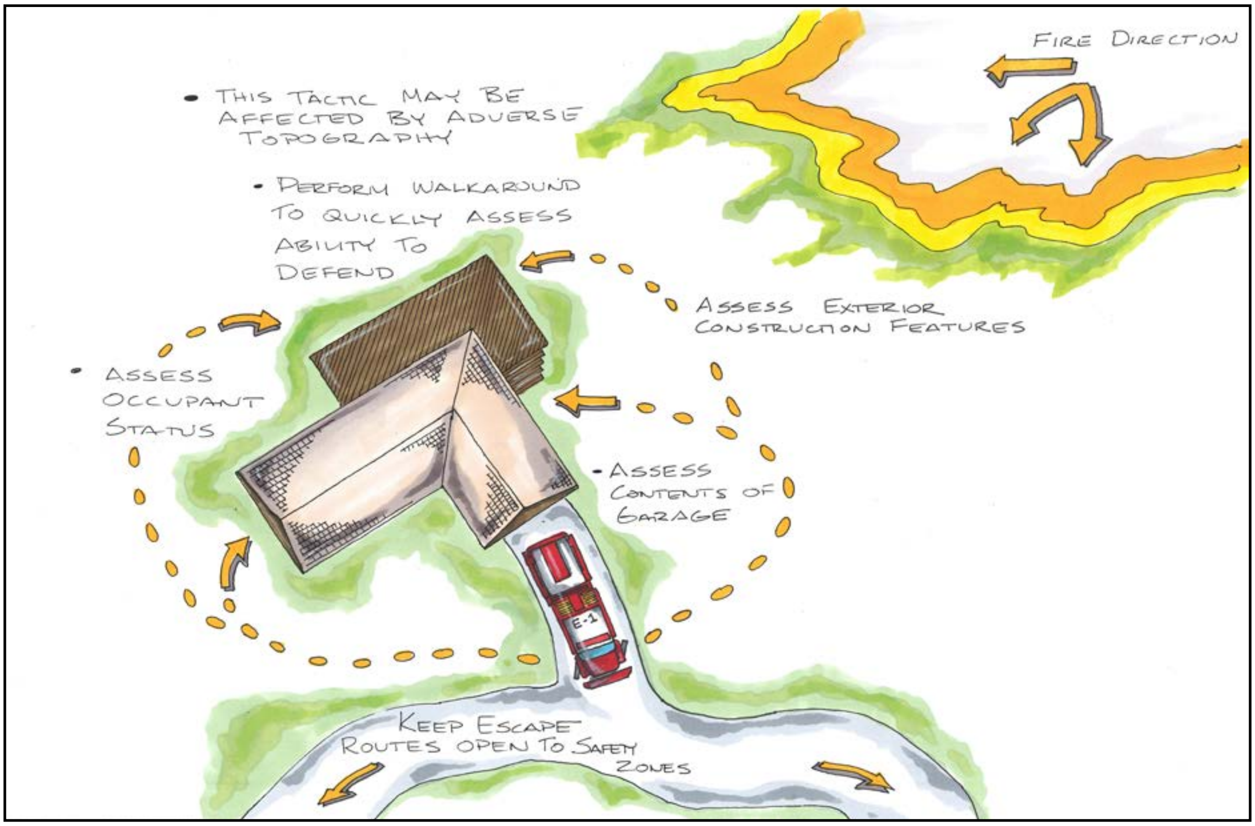


Figure 5.40. Illustration of Check and Go.

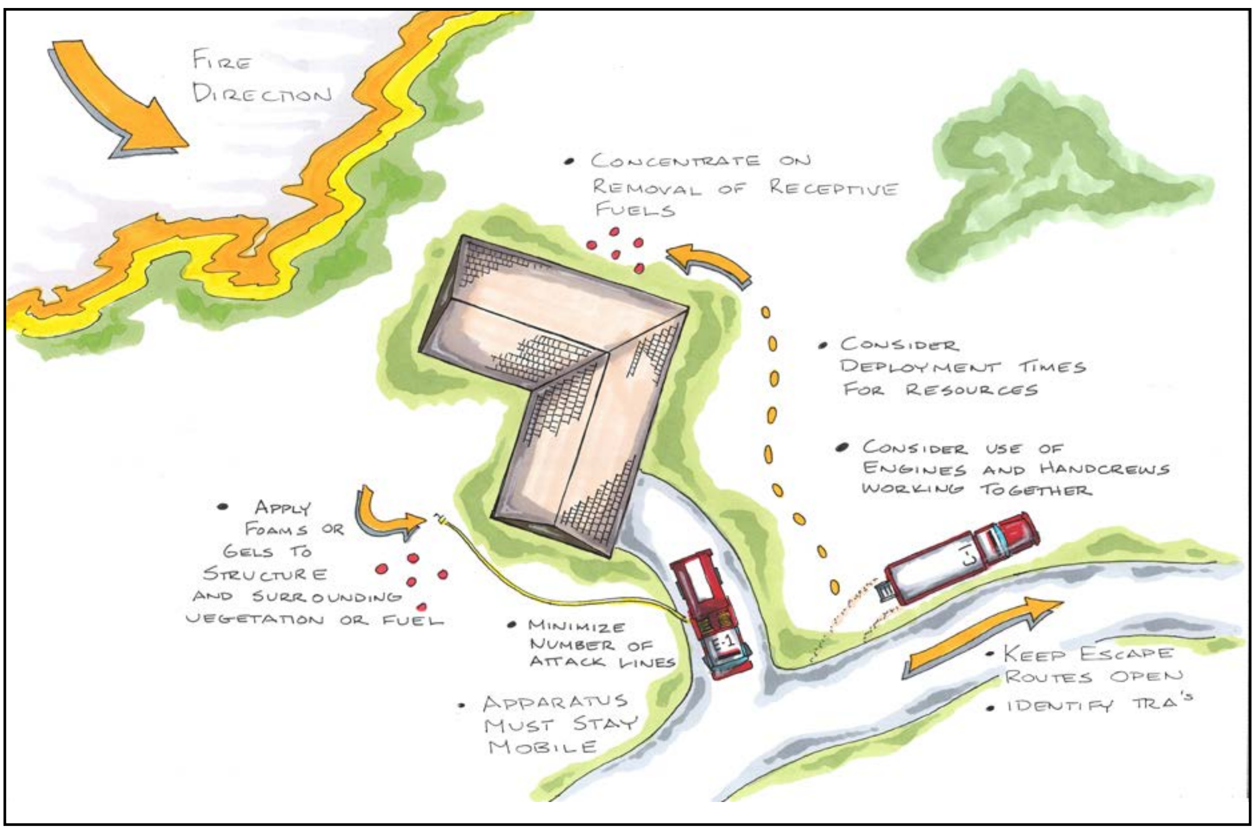


Figure 5.41. Illustration of Prep and Go.

more prudent to deploy one engine at every residential structure or structure compound.

As with check and go and prep and go, engines should position themselves for a hasty withdrawal as soon as they enter the immediate structure area. After identifying a TRA, escape route and safety zone, and sizing up the structure defense problem, engine companies should identify and prioritize the tasks that must be completed prior to fire front impact, once again, concentrating on the fire impact side of the structure.

Figure 5.42. Engines using the Prep and Defend tactic should back into position, ladder the roof for debris removal, provide a water source to the engine from the structure, and concentrate preparation efforts on the fire impact side of the structure.

Concentrations of fuel should be thinned and removed from the immediate vicinity of the structure and scattered in such a manner that the fuel poses no threat of radiant, convective, or direct flame ignition to the structure or utilize gels and foam or apply to the vegetation. Limb up ornamental and natural vegetation to disrupt vertical fuel continuity. Wooden fences that pose a threat should be foamed, gelled, or removed altogether. Flammable yard furniture should be stored in the garage or sheltered on the lee side of the structure. Decks should be foamed or gelled including the underside and vegetation under the deck. Engine crews should enter the structure to ensure windows and window coverings are closed. Ember traps such as gable end vents, attic and foundation vents, and any other openings into the structure should be covered and monitored. Access the roof and clean as much debris from the roof as possible. If rain gutters are full of flammable material, water or gel should be applied to reduce the risk of ignition. Shake or shingle roofs and flammable siding should be foamed or gelled. Propane or other above ground fuel tanks should be protected by removing adjacent fuel.

Prep and defend is an excellent tactic for fire crew and dozer strike teams especially when working in tandem with engine strike teams. Along with standard structure defense hardening tasks, fire crews and dozers can construct control line around structures or groups of structures. Fire crews provide a large labor pool to conduct firing operations around structures including a holding force to ensure the applied fire does not escape control. Once these tasks are completed, the dozer and fire crew strike teams can move on to the next structure and assist other elements of the engine strike team.

Bump and Run

Engine, fire crew and dozer strike teams are all very well suited for this fast paced tactic. Strike team leaders must ensure that all elements of the strike team understand the tactic and the risks involved when engaging the fire in the spotting zone ahead of the fire front.

Engine strike teams working in the spotting zone should concentrate on controlling spot fires before they ignite structures by using mobile attack tactics and constructing scratch line as needed.

There is generally very little structure defense preparation associated with bump and run. If a structure becomes involved in fire, individual engine companies or the strike team leader must make a decision whether to engage the burning structure and tie up an engine at the risk of losing threatened structures down wind, or abandoning the burning structure adding to ember production threatening structures and vegetation down wind.

The engine strike team leader must remain mobile and diligent as the strike team moves within the spotting zone. Escape routes and safety zones must be constantly re-established as the strike team advances. The strike team leader must advise of changes in fire behavior that may not be observed by the strike team. The strike team leader must coordinate with other suppression resources working in the same area to avoid confusion and duplication of efforts.

Fire crew strike teams can support engine companies in the spotting zone if the fire behavior is low to moderate. This is usually limited to hasty control line or scratch line construction and perhaps some limited firing operations. Once a fire crew leaves its transportation, it is vulnerable if there is a disadvantageous change in fire behavior. A safer and more affective use of both fire crew and dozer strike teams is in a flanking tactic constructing control line. As with engine strike teams, fire crew and dozer strike team leaders must remain diligent throughout the bump and run operation advising their resources of changes in escape routes and safety zones as well as changes in fire behavior and incident status.

Figure 5.43. Fire crew strike teams can quickly construct control lines around structures or corral numerous spot fires.

Fire Front Following

As with the bump and run tactic, fire front following is well suited for engine, dozer and fire crew strike teams who basically follow the fire front as it moves through an area extinguishing fire that threatens structures and extinguishing partially involved structures. This tactic is especially applicable for any fast moving WUI fire where extreme fire behavior makes it unsafe to be in front of the fire.

An engine strike team can move into an area of threatened structures after the fire front has passed and as soon as it is safe and cool enough to do so. Engines must quickly prioritize their targets concentrating on structures that are minimally involved in fire or immediately threatened by fire. The degree of structure involvement will dictate whether to commit to structure suppression or abandon the effort and move on to another less involved structure. Strike team engines should communicate closely with one another and advise of adverse fire behavior changes or hazards that threaten their position. When possible, firefighters should conduct primary searches of the area to look for fire victims and render aid to survivors.

Strike team leaders must coordinate their resources to ensure the strike team remains in fairly close

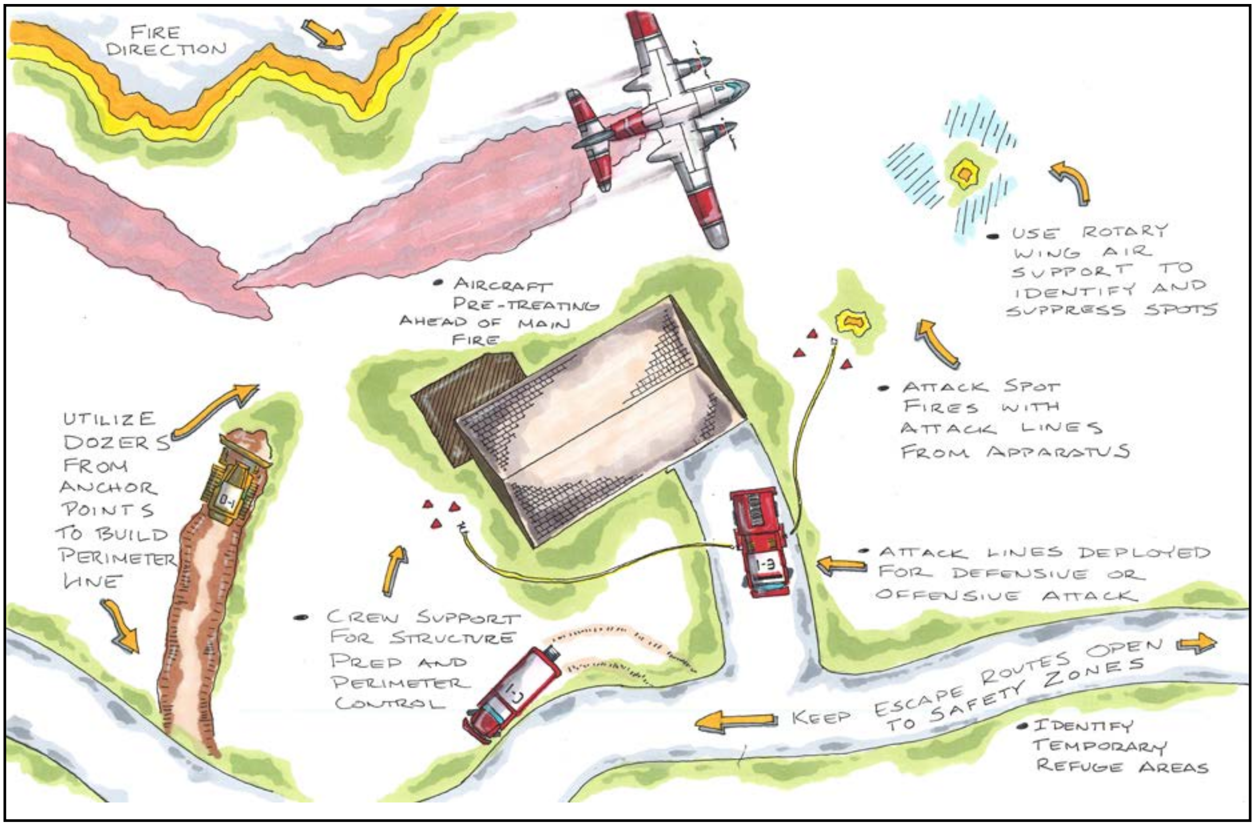


Figure 5.44. Illustration of Prep and Defend.

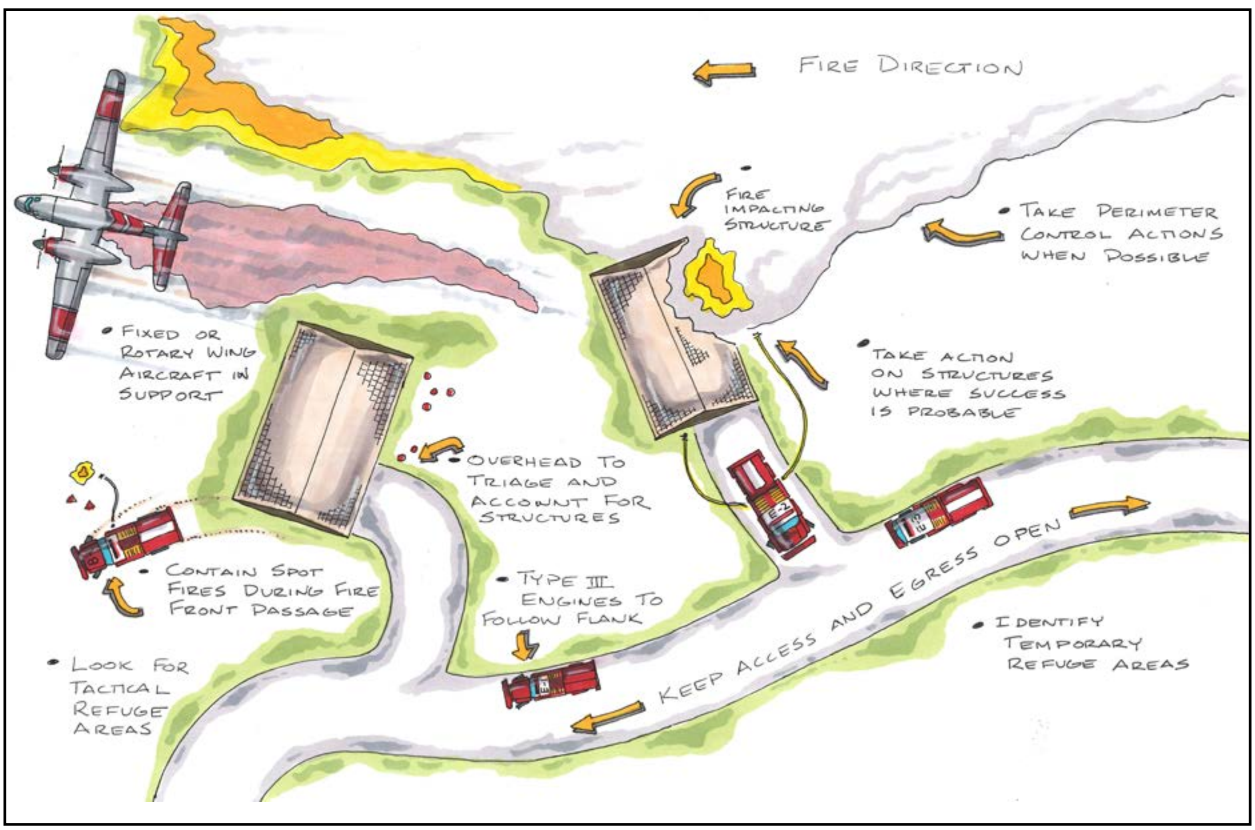


Figure 5.45. Illustration of Bump and Run.

proximity and that the location of TRAs, escape routes and safety zones is known by all elements of the strike team as these safety options will change as the strike team moves with the fire front. Conditions area generally less favorable during a fire front following operation with a hot, smoky atmosphere hampering visibility and performance. Engine companies must maintain heightened situational awareness and watch for hazards that could trap an engine such as creeks, ditches or abrupt drop-offs.

Long hose lays are generally not a tactical option when engaged in fire front following. Typically, shorter pre-connect hose lines are used to quickly knock down hot spots and active fire line that threatens structures. Engine crews should be prepared to use hand tools to construct hasty control lines to control creeping or smoldering fire. Utilize gels and foams to assist with fire suppression and mop-up.

Fire crew strike teams are effective using the fire front following tactic, especially in densely arranged structures. Fire crews can quickly construct control lines around individual structures or groups of structures, and conduct firing operations in support of offensive or defensive tactics. Fire crews can work in tandem with engines and dozers to maximize the effectiveness of these resources. Fire crew strike team leaders must remember that once deployed, fire crews are subject to delay if asked to redeploy to a new tactical area.

Figure 5.46. Dozers can construct control lines around single structures or groups of structures and take action on spot fires before they become unmanageable.

Dozer strike teams are somewhat limited when using the fire front following tactic, especially when structures are densely arranged where maneuverability and loading and unloading dozers is affected by the lack of space. In areas where structures are sparsely arranged, dozers are very effective constructing control lines around individual structures or groups of structures. Perhaps the best use of a dozer strike team is in a flanking tactic to control the fire's perimeter. Strike team leaders should ensure that damage to structures and property is minimized by using scouts to aid dozer movement in the smoky conditions associated with fire front following.

Anchor and hold

The goal of anchor and hold is to stop the forward spread of the fire and mitigate the exposure (unburned structure) threat where fire spread is predominately structure to structure via radiant heat, ember ignition, or direct flame impingement. Strike team leaders should view anchor and hold in the context of "making a stand" using an established control line such as a street or road.

Anchor and hold is ideally suited for engine strike teams especially Type 1, 2, and 3 engine strike teams. Anchor and hold is a somewhat stationary tactic that requires a high volume water supply delivered by an engine with the pump capacity to maintain a constant water flow to multiple attack lines and master stream devices.

Strike team leaders with an anchor and hold assignment should ensure that the supply engine is spotted in a safe position where it cannot be overrun by fire, and that TRAs, escape routes and safety zones are identified should conditions deteriorate. A supply line should be deployed along the length of the anchor and hold line with lateral hose lines spaced appropriately for the structure density. These lateral hose lines should be deployed to individual structures for structure fire suppression, exposure defense with water curtains, and direct perimeter control.

Figure 5.47. The Anchor and Hold tactic is well suited for engines capable of flowing large volumes of water with master stream devices.

The remaining strike team engines should be deployed along the anchor and hold line and instructed to staff lateral hose lines and take direct action on threatened or partially or fully involved structures, with hand lines or master streams.

Secondary engine strike teams should be deployed to patrol down wind of the fire front to extinguish spot fires established in vegetation or on structure roofs and decks.

Fire crew strike teams can be useful for the anchor and hold tactic. Fire crews can work in tandem with engine companies to staff hose lines and suppress **exterior** structure fires. Crew strike team leaders must remember that fire crews are not trained and equipped with SCBA and proper structural PPE for structure fire fighting and their use is limited for this tactic. Fire crews should be used for firing operations, perimeter control, and are effective for spot fire control in down wind fuel beds.

Figure 5.48. Properly trained and equipped fire crew strike teams can staff hose lines and perform numerous ***exterior*** *structure suppression or exposure defense tasks when Anchor and Hold is used.*

Dozer strike teams have limited use during anchor and hold operations. Dozers should be staged down wind from the fire front and be prepared to take action should the tactic fail or a spot fire escapes initial attack by engines or crews.

Connect the dots

Connect the dots is a tactic well suited for all kinds of strike teams. Engine strike teams should concentrate on spot fire control and open fire line suppression when the open line threatens structures. The focus is on suppressing the fire before it reaches a threatened structure and then connecting areas of secure perimeter line forming a section of secured fire perimeter. Structure fire suppression on partially involved structures should be a priority to control ember production. Strike team leaders should evaluate structures that are significantly involved in fire and

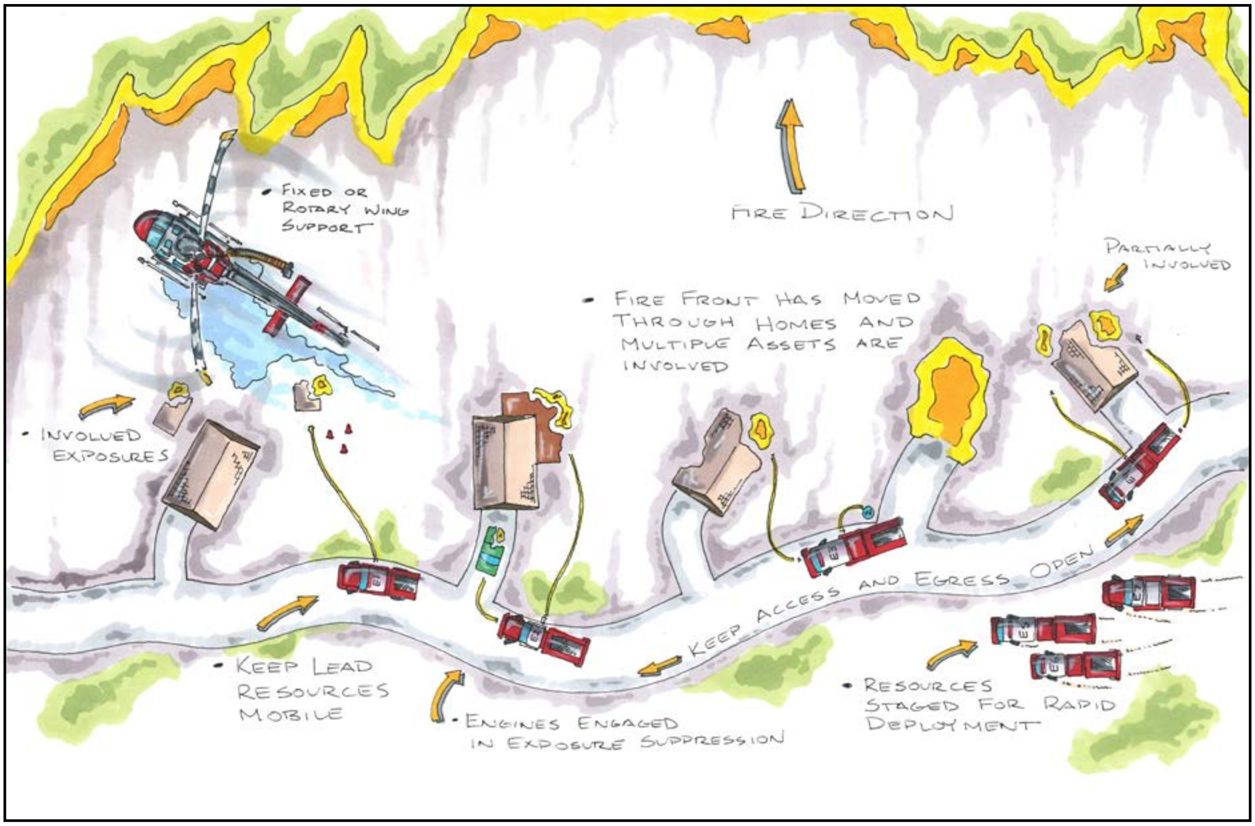


Figure 5.49. Illustration of Fire Front Following.

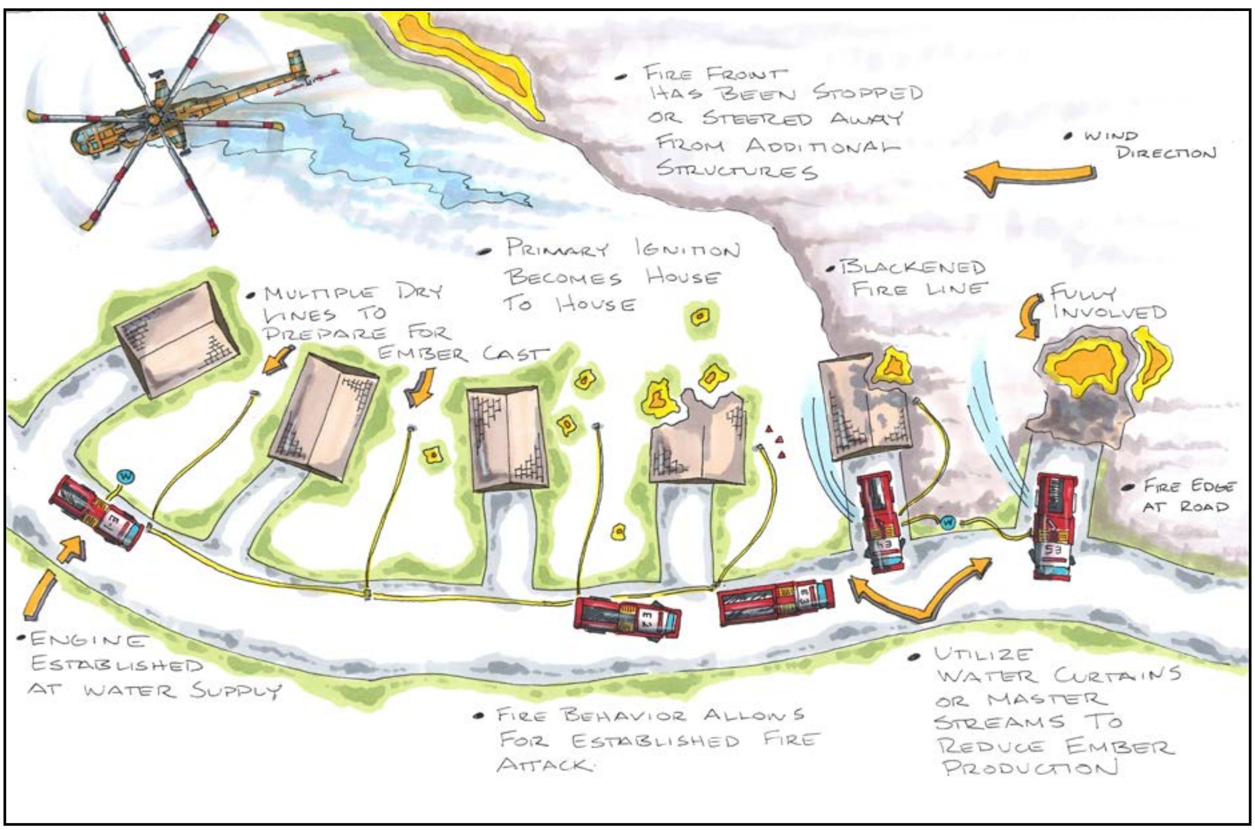


Figure 5.50. Illustration of Anchor and Hold.

determine if committing an engine to a fully involved structure is the most appropriate use of the resource. If the structure is allowed to burn, is it close enough to the secured fire perimeter that the resulting ember showers would create additional spot fires? Is there a structure threat elsewhere where strike team resources would be more effective and where more structures would be saved?

Strike team leaders should always consider forming engine crews into a fire crew in order to expedite perimeter control, connecting one section of secured perimeter line to another. When fire crew strike teams are available, they are very effective for this tactic.

Fire crew strike teams may be split into two separate crews to cover as much of the tactical area as possible. They should be instructed to assist engine companies and concentrate on open fire line that directly threatens structures and to assist with structure defense preparations as needed. Fire crews should be used to construct control lines around threatened structures or groups of structures, and corral and suppress spot fires before they become unmanageable. Fire crew strike teams should be used to construct control lines connecting multiple sections of secured perimeter line especially in rugged terrain inaccessible to dozers.

Figure 5.51. Fire crew strike teams are an excellent resource for constructing control lines between secured "dots" when using the Connect the Dots tactic.

Dozers are well suited for the connect the dots tactic because of their ability to cover large sections of terrain in a fairly short period of time. They are, however, limited by structure density and are not as useful when property destruction is a concern. Their primary function should be to connect sections of secured fire perimeter and to corral areas of multiple spot fires. A dozer strike team can be split and individual units can work in opposite directions to cover even more terrain.

Tactical Patrol

Tactical patrol is quite possibly one of the most overlooked and under used suppression tactics in the WUI theater suited for all kinds of strike teams, especially engine and fire crew strike teams. Strike team leaders should view tactical patrol as an aggressive search and neutralize assignment.

Engine strike team elements should be given a section of the tactical patrol area and instructed to conduct saturation patrols to locate and extinguish any hot spots or creeping fire around structures and the perimeter edge of islands. Priority should be given to the areas immediately surrounding structures where

Figure 5.52. Engine crews should aggressively search out and extinguish hot spots and creeping fire using hose, backpack pumps and hand tools.

engine personnel should check exterior siding for heat, adjacent fuel beds such as wood piles and concentrations of vegetation for smoldering fire. Gels and foams can be used to aid in mop-up and prevent re-ignition of fuels. If the structure has been previously involved in fire it should be entered and re-checked to ensure that no hot spots remain in the interior; this would include checking the attic and sub-floor area where embers can enter through open vents. Once secured, the structure should be re-checked throughout the operational period. Fire crew strike teams should be assigned to work in tandem with engine companies to accomplish this task.

Figure 5.53. Fire crew personnel should be deployed in teams of two during Tactical Patrol, each with a hand tool and one with a backpack pump if available, otherwise, teams should work in tandem with engine companies.

Fire crew strike teams should also be assigned to grid the tactical patrol area, walking forward in a line, "shoulder to shoulder" to assess as much ground as possible. The use of back pack pumps should be encouraged to maximize the efficiency of the crew.

When not involved in a gridding operation fire crew personnel should be deployed in teams of two, both individuals with a tool, (cutting and scraping) and a back pack pump for water unless they're working with an engine company.

Dozer strike teams are limited for tactical patrol but should be considered as a contingency resource should a spot fire escape control or if needed to construct large sections of perimeter control line .

Task Forces

The task force concept is ideal for any WUI incident that escapes initial attack. In the past, a task force was formed at the incident from a pool of single resources more as a convenience rather than in support of the incident strategy. Task forces are formed for a specific task or challenge: structure defense, a major firing operation, or contingency operations. A task force should fit the challenge for which it was formed.

Tasks for a WUI specific task forces may include:

- Structure defense
- Suppression related damage inspection and repair
- Structure defense, triage planning, and preparation

The primary task force consideration in the WUI is structure defense. The formation of a task force for this purpose should reflect the terrain the task force will be working in, structure density, equipment accessibility, water availability, and fire behavior to name a few. A task force for structure defense in an urban area should be composed predominately of Type 1 or 2 engines for their pumping capacity, perhaps one Type 3 engine for mobility, a water tender, and possibly a fire crew for its large labor pool. In a more rural setting with greater variations in terrain and generally more vegetation, a WUI structure defense task force might include three or four Type 3, 5, or 6 engines, one fire crew, one water tender and one dozer.

A task force can perform all of the same tasks that a strike team can perform for the given tactical action with the exception of Check and Go. The task force leader must understand the limitations of the various elements of the task force and not commit a resource to a task it cannot safely or efficiently complete.

FIRING

Firing Operations

Firefighters can use applied fire (known as firing) to help defend structures, infrastructure, and improvements; secure perimeter control lines; and create or expand safety zones and temporary refuge areas. It is essential that company officers understand the basic principles of firing to ensure that the firing operation produces the desired results. The company officer must understand how to control applied fire based on the current conditions by utilizing a variety of firing techniques.

Figure 5.54. Judicious use of applied fire in the WUI can aid in securing perimeter lines and defending structures.

Firing requires a great deal of coordination and experience. Knowing how and when to implement a firing operation may hasten fire containment; however, indecision, lack of resources, or poor timing may result in an applied fire escape causing a larger fire front, compromising firefighter safety, and adding more problems to the incident.

This document does not provide all of the information required to implement specific firing actions. For further information regarding firing techniques, courses such as Intermediate Firing Course; NWCG S-234 or CAL FIRE C-234 are required.

Backfire and Burnout

A *backfire* is a fire set ahead of the main fire with the expectations it will influence and/or be influenced by the main fire. It is set with the intent of slowing, stopping, or redirecting the spread of the main fire.

Burnout is setting fire inside a control line to consume fuel between the edge of the fire and the control line, creating *blackline*.

Backfire
A fire set ahead of the main fire with the expectations it will influence and/or be influenced by the main fire. It is set with the intent of slowing, stopping, or redirecting the spread of the main fire.

Blackline
A blackline denotes a condition where there is no unburned material between the fire line and the fire edge.

	BACKFIRE	BURNOUT
Advantages	• Indirect attack • Eliminates fuel • Reduces fire intensity • Increases tactical options	• Direct or indirect attack • Strengthen/secure control line • Reduces holding needs • Reduces mop-up • Provides safety zones
Disadvantages	• Firefighter safety • Applied fire control issues • Additional planning, preparation, and coordination • Increases acreage burned • May negatively influence other divisions	• Increased risk of spotting across control lines • Smoke management issues • Increased acreage burned

Because backfire is rarely used around structures, burnout is far more common in the WUI environment.

Legal Authority

Any person lighting a backfire or causing a backfire to be set must have the legal authority to act on the behalf of their fire agency. The following California codes give that authority to firefighters involved in fire suppression efforts.

- Public Resource Code 4426
- Health and Safety Code 41801
- Health and Safety Code 13055

Figure 5.55. Though large backfires are generally not the rule in the WUI, they are used on occasion with great success when properly planned, prepared and carried out.

These codes provide the authority to set backfires; however, liability may rest on the person lighting the fire if he or she is not properly trained or found to be negligent in his or her actions. Applied fire may have severe consequences for errors or omissions. When considering non-emergency firing operations, line supervisors should stay within the scope of their training and experience and must ensure that firing authority has been granted to them.

Burn Zone
A zone or buffer created between the fire's edge and the control line to reinforce the control line.

Positive Firing Conditions

Firing is a valid option when:
- There is ample time to create a sufficient *burn zone* around a structure or buffer along the edge of a control line.
- The fire intensity is too severe for direct attack tactics making indirect tactics and firing to

create a blackline a prudent tactical choice.
- There is an opportunity to use fire effectively in a situation where resources must take immediate action to save a structure or stop fire spread at a desired control line.
- There is a high level of certainty that the applied fire will be controlled.

CAL FIRE Policy

"Except where immediate firing is necessary to prevent the loss of life or major property damage, all firing operations shall be communicated to the appropriate ICS supervisor prior to the commencement of the firing operation. The officer supervising the firing operation shall remain in communication with his/her ICS supervisor and adjoining forces to the extent possible." CAL FIRE Handbook 7013.4.2

The IC has the ultimate authority and responsibility to initiate backfire or burnout operations. As the incident organization expands, the IC may delegate the responsibility and authority. A normal progression of delegation, depending on the complexity of the incident, would be from the IC to the operations section chief who could delegate the authority to the branch director, division supervisor, strike team leader, taskforce leader, or single resource company officer.

Figure 5.56. Prior to initiating a firing operation, a briefing with all involved personnel using the standard briefing format must take place.

Safety must be the first priority for any firing operation. All personnel shall follow the Ten Standard Firefighting Orders and 18 Watch Out Situations, and establish and maintain LCES. A firing team leader, working under the direction of the branch director, division/group supervisor, or operations chief, may supervise firing operations.

Firing Operational Briefings

WUI firing operational briefings are usually spontaneous because firing in the WUI is generally an immediate need, not a planned need, operation. Some briefing information may be covered en route to the incident or while driving between structure defense locations. Continuous briefings must occur as conditions change or when defending multiple structures. Utilize the briefing checklist in the IRPG.

Briefings must, at a minimum, address the following points:
- LCES and downhill guidelines (in place and maintained)
- Hazard mitigations
- Objective of the firing operation (known and understood by all participants)
- Location of the firing operation in relation to main fire (known and understood by all participants)
- Identified anchor points and start and end points
- Current and forecasted weather including on site observations
- Current and forecasted fire behavior including constant observation of the main fire and an

evaluation of the effectiveness of the applied fire

- Tactical frequencies (assign separate tactical frequencies on large operations)
- Fuels, in particular the fuel carrying the fire, and an understanding of fuel conditions for the entire firing operation
- Topography (for the entire firing operation)
- The firing plan, even if unwritten (known and understood by all participants)
- Structures adjacent to or in the path of the firing operation (identified and prepared for defense)
- Identified resources participating in the firing operation (ensure assignments are understood)
- Time frame (identify window of opportunity)
- Fuel alteration along the firing route (completed before the firing team arrives)

Developing a Firing Plan

When conducting a firing operation around structures, the current and forecasted fire behavior and window of opportunity for completion will dictate how much time is available to plan the operation.

There are two classifications of firing operations: the immediate need firing operation and the planned need firing operation. On major fires, the Incident Management Team (IMT) utilizes a formal firing plan form for planned need completed by the operations section and planning section chiefs. For an example of a Firing Plan, see appendix A page A-5. On initial attack fires or for immediate need firing operations, the plan may not be written. In either case, there are several planning elements that must be considered prior to initiating a firing plan.

Immediate Need

Immediate need firing operations are used for situations such as structure defense, when a delayed firing decision may compromise incident objectives or values at risk, or when the fire activity threatens to overwhelm suppression resources. Immediate need firing operations generally involve minimal use of applied fire. Firefighters apply only enough fire to protect the threatened area or value at risk.

Figure 5.57. Controlled firing around structures to create an adequate burn zone is an effective tactic when fire impact is imminent or when resources are limited. Photo courtesy of Kari Greer.

The applied fire is usually of low intensity and must be controlled by firefighters prior to leaving the tactical area. Immediate need applied fire is not intended to move beyond the values being defended which would adversely affect downwind firefighters or structures. Immediate need firing operations support defensive tactical operations.

Regardless of the firing strategy suppression personnel must obtain approval from the appropriate line supervisor ultimately responsible for the firing operation, and make the necessary notifications to adjoining forces prior to initiating the burn. Firefighters must identify a start and end point for the firing operation and must make those points known to all resources involved directly or indirectly in the operation.

When firefighters do not have time to prepare a formal or written plan prior to starting a firing operation, they should use the Immediate Need Firing Operation Checklist to ensure that appropriate items are considered. See appendix A page A-8 for the Immediate Need Firing Operation Checklist.

Planned Need

Planned need firing operations are generally large fires ignited to influence the direction or movement of the main fire front or to secure indirect control lines located some distance from the main fire. Planned need firing generally takes place well away from the main fire and away from the values being protected.

Figure 5.58. Planned need firing operations are generally large scale events fired from established control lines well away from the main fire or any values at risk.

Planned need firing in the WUI environment requires significant planning and coordination. Identifying the tactical firing area, anchor points, resource needs, weather forecasts, logistical needs, and experienced personnel to conduct the operation are just a few of the planning criteria that must be addressed. Planned need firing operations support offensive tactical operations.

For a planned need firing operation, resources will need to develop a formal written Incident Firing Plan (covered later in this chapter).

Firing Considerations

Firing operations are one of the most complicated and dangerous operations firefighters may undertake. Mistakes or misjudgments have resulted in death and injury, not to mention additional burned acres and the loss of valuable infrastructure. Firing should only be selected after considering all other tactics.

Whether planning for an immediate need or planned need firing operation, planners should address the following:

- Objective
- Conditions
- Risk
- Resources
- Ignition sequence
- Communications
- Safety/LCES
- Chain of command
- Notifications

Figure 5.59. The objective of any firing operation must be known and understood by all participants. Knowledge of the tactical firing area and anchor points is crucial for operational success.

Objective

Every firing operation, whether broad in scope or confined to isolated tactical areas, must have an objective. The objective must be clear and understood by everyone involved in the burn. For example: Create a blackline from Division A to Division B using existing roads and dozer line by burning the understory fuels while minimizing damage to timber. If the firing objective cannot be met the resources should implement an alternate plan.

Conditions

- **Weather**: Planners must know current and forecasted weather conditions and incorporate them in the planning process. A wind shift halfway through the firing operation could make holding the fire within the control lines problematic. Monitor current and forecasted temperature and relative humidity. Generally speaking, the higher the temperature, the lower the relative humidity, which may result in increased applied fire behavior. Conversely, lower temperatures and higher relative humidity may dampen applied fire behavior leaving an abundance of unburned fuel in the burn area which could reignite when conditions heat up and dry out.

- **Fuels**: Evaluate the vegetation in the firing area. Are control lines adequate to hold the fire given the condition of the fuel carrying the fire? Are there pockets of heavy fuel adjacent to the control line or near the structure? If so, remove, reduce, or treat them with foam or gel. Heavier fuel loads require longer time commitments from prep and mop up resources. If the fuels are too sparse, it may be difficult to fire.

- **Topography**: Topography affects both the main fire and the applied fire. Firefighters may not be able to fire around a mid-slope structure without the threat of losing control of the fire and threatening personnel and structures above the firing operation. Firing teams negotiating steep, rocky slopes, or maneuvering through drainages or chimneys will most likely be slowed to the point of an unacceptable delay in the firing operation. Changes in topography require changes in firing techniques. Saddles must be fired from both ends concurrently; uphill control lines are generally fired from the top down and against the wind; deep drainages on the control line may need to be fired and secured in advance of the main firing team.

- **Fire Environment**: The fire environment includes fuel, weather, and topography. Each factor should be evaluated in concert with the others. Firefighters must maintain situational awareness of the entire fire environment after examining each factor separately. Only then can firefighters safely plan and implement a firing operation in support of offensive or defensive tactics.

- **Window of Opportunity**: Given the fire environment for the burn area, establish a time frame for the firing operation that meets the firing objective. Occasionally, firing conditions change, adversely impacting the operation's objectives; either too much heat and fire or not enough heat to carry the burn. Firing tactics and equipment may need to change to accommodate changes in fuel, weather, or topography. If there is no window of opportunity or the window closes, cancel the firing operation in favor of a secondary plan.

Risk

What are the possible adverse affects of using applied fire? Will the applied fire run into adjacent structures or resources? Will it increase the intensity of the main fire? Will it increase spot fire production? What will be the resulting fire behavior? Will the applied fire be controllable?

Figure 5.60. With safety the primary consideration, fireline supervisors may choose the option NOT to fire if the main fire is backing downhill in a controlled manner toward an established control line. Photo courtesy of Kari Greer.

Current rates of spread, fire intensity, values at risk, resource availability, capability and training must all be considered when evaluating risk. Initiating a firing operation during an already established WUI incident may require additional resource commitment, increase incident complexity, and compromise firefighter and civilian safety.

Fire line safety is the top priority when considering risk. A firing operation should not increase firefighter risk or cut off escape routes to identified safety zones and temporary refuge areas.

The best decision may be to not initiate a firing operation in the first place.

Figure 5.61. There may be immediate-need situations where a single engine company fires a control line and holds that firing operation by itself.

Resources

Resources identified for the firing operation must understand their roles and responsibilities. Key positions to fill for a planned need firing operation include:
- Holding forces adequate to meet the anticipated burning conditions and spotting potential
- Ignition team
- Lookouts
- Firing team supervisor (for very complicated or lengthy firing operations)
- The necessary firing tools and support equipment to meet the needs of the operation

During an immediate need firing operation, a single resource may be required to fill all of these roles. Even when one engine is defending one house, each of these roles must be covered.

If additional resources are needed, consider how diverting those resources from their current tasks will impact overall suppression efforts.

Firing tools and support equipment should be available to the firing team before the firing operation begins.

Ignition Sequence

Develop an *ignition sequence* and brief all resources assigned to the firing operation. The ignition sequence may become more complex when multiple ignition teams fire from multiple anchor points, or when fuel, weather, or topographic features adversely affect the firing operation. Changing conditions may change the ignition sequence.

Ignition Sequence orchestrating the steps involved to successfully complete the firing operation.

Communications

Before setting an applied fire, the appropriate ICS supervisor and adjoining forces must be informed that the firing operation is about to begin. For large-scale or extremely complicated firing operations, the firing team and holding team leaders may require their own dedicated tactical frequencies and must monitor command and air-to-ground frequencies as well. For an immediate need firing operation, use the current assigned command and tactical frequencies.

Figure 5.62. Safety is the number one priority during any firing operation. LCES must be in place and all participants must wear the complete wildland safety ensemble.

Safety/LCES

Firefighter and public safety should always be the top priority during any firing operation. Review potential hazards or safety concerns and mitigate them if possible before firing.

A firing operation should include lookouts to observe fire behavior, monitor fire progression, and assist guiding the ignition team to established escape routes. Establish communications using hand signals, mobile and hand-held radios, or a separate tactical frequency (for larger scale operations involving numerous resources). Identify and communicate the location of escape routes, safety zones, and temporary refuge areas.

Large-scale or planned need firing operations may require the assignment of an experienced safety officer well versed in large scale technical firing operations. The Safety Officer's duties are discussed in greater detail in chapter 10.

Chain of Command

The firing group or firing team must understand the chain of command and each individual's role in the firing operation. A firing group supervisor normally reports to the operation section chief or the branch director if the firing operation will impact multiple divisions. Division supervisors should supervise resources conducting firing operations in their division. Supervision can be delegated to the company officer level, however, division supervisors should be present and provide oversight at the scene of any large scale or complicated firing operation in their division.

Notifications

Identify the appropriate line of communication within the chain of command for the firing operation. Before firing, ensure that all required notifications are made. It is also important to notify other resources working near the firing area. Uninformed adjoining resources may attempt to suppress an applied fire if they are not included in the communication loop. The ATGS must be informed of the firing operation so that air resources do not inadvertently make retardant drops on the applied fire.

Firing Strategies

Using fire to fight fire is one of the most dangerous tactics available to wildland firefighters. Firefighters should not initiate a firing operation without understanding the overall strategy and objectives and how they relate to firing tactics.

Before initiating a firing operation, firefighters must determine whether they are supporting defensive or offensive tactical strategies based on the current incident situation or the objectives set by the IC .

Firing In Support Of Defensive Tactical Actions

Firing that supports defensive tactical actions uses only enough fire to create a buffer zone to defend an area or structure; suppression resources must be able to control the applied fire. ***It is unacceptable to allow applied fire to run uncontrolled, impacting personnel or other structures downwind or up slope.***

Burn zones between the fire and the structure being defended should be a minimum of four times the forecasted flame length. This is not always possible in the WUI due to structure density or other factors.

Firing in Support of Offensive Tactical Actions

Firing operations in support of offensive tactical actions can be used to positively influence a fire or defend structures through large-scale firing operations. Use large strips of fire and appropriate firing patterns with a predetermined start and end point to protect structures or a community .

Applied Fire Behavior

WUI firing techniques are based on observed fire behavior factors (fuel, weather, and topography) and the number of resources participating in the operation. The proximity of the main fire to the applied fire and the proximity of threatened structures to the main fire and applied fire should also be considered.

Basic applied fire behavior falls into three categories:
- Backing fire
- Flanking fire
- Head fire

When firing, resources may need to modify or mix the ignition patterns to safely achieve the desired results. One ignition pattern is rarely used throughout an entire firing operation. Typically, the firing group uses a combination of patterns as it moves around the structure or along the control line.

Firing Patterns	APPLIED FIRE BEHAVIOR		
	Backing Fire	Flanking Fire	Head Fire
Edge Firing	X		X
Strip Firing	X		X
Spike Firing		X	
Dot Firing	X	X	X

Backing Fire

A backing fire spreads against the wind or slope. Exercise caution on very steep slopes or mid slope roads. Watch for rolling material that may ignite fires below. Watch for uneven fire edge that could hook and run uphill.

Flanking Fire

A flanking fire spreads perpendicular to the wind or slope, spreading at right angles to the control line. Bringing fire perpendicular to slope or wind allows for moderated fire behavior as fire spreads sideways.

Head Fire

A head fire spreads with the wind or slope. Head fire creates the most intensity and potential control problems. During any firing operation, resources may inadvertently create unintended head fire. Be very cautious with fire intensity to avoid this situation.

Firing Patterns

Firing patterns will result in one or more of the three types of applied fire behavior (fire spread). Patterns are described by orientation relative to the control line.

Edge or Perimeter Firing

A fire set along the edge or perimeter of a control line.

An edge does not necessarily denote a straight line. Control lines around a structure conform to structure defense needs and can take on a variety of shapes.

To create a backing fire using the

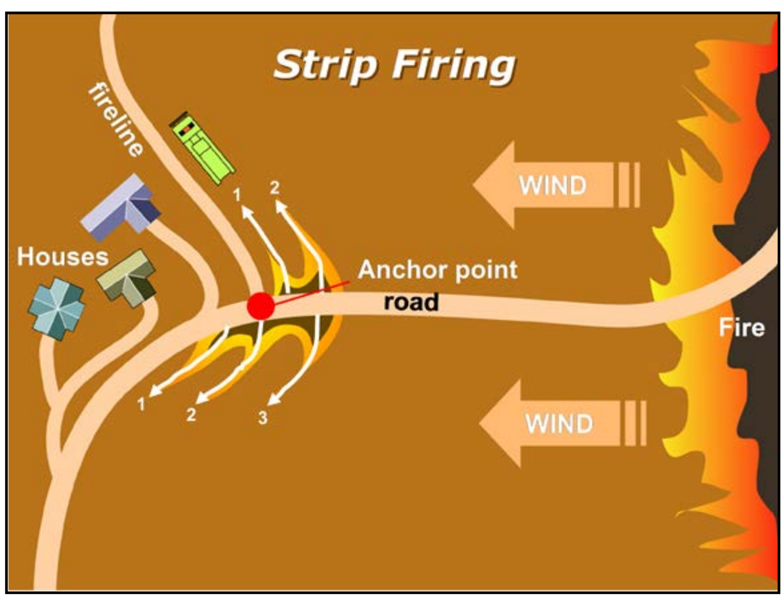


Figure 5.63. Strip Firing

edge firing pattern, fire into the influence of the wind or slope. To create a head fire, fire with the influence of the wind or slope.

Strip Firing

A strip or strips of fire set parallel, and interior of, a control line.

With a simple strip firing pattern, a single igniter walks along the control line laying a continuous strip of fire. To intensify a simple strip firing pattern, the igniter can use an "S" or zigzag variation.

The 1-2-3 and 3-2-1 strip firing patterns require multiple igniters each assigned a number (1, 2, 3, etc.) The number 1 position is always closest to the control line but may not always be the lead igniter. Spacing between the igniters should be established prior to beginning ignition.

Figure 5.64. In the strip firing technique, the number one burner is always closest to the control line.

Use the 1, 2, 3 pattern for head fire spreading toward the control line, and backing fire spreading toward the main fire. In this case, the number 1 igniter is the leading igniter and is closest to the control line.

Use the 3, 2, 1 pattern for head fire spreading toward the main fire, and backing fire spreading toward the control line. In this case the number 3 igniter is the lead igniter even though the number 1 igniter is closest to the control line.

The strip fire pattern is used when the slope or wind are not favorable for other firing methods. Strip firing works best in light flashy fuels. Varying the rate of firing, number of igniters, and depth of the strips helps control fire intensity.

Strip firing always creates a head fire while simultaneously creating backing fire on the windward side of the strips.

Spike Firing

Lines of fire set into the influence of the wind or slope.

- There are variations of the spike pattern:
- Straight spikes
- "S" or zigzags
- Chevrons (where the burn pattern resembles an inverted "V" shape)

The distance between the spikes determines the fire intensity. The spikes will influence each other and the perimeter of the fire.

"S" spikes curve in a zigzag pattern. Tighter zigzags burn at a lower intensity than wider zigzags.

With a chevron, the burn pattern resembles an inverted "V" shape. It is used to quickly widen control lines and burn down ridge lines to modify intensities and provide for firefighter safety. Igniters drag strips of fire down ridge lines and allow fire to flank/back into drainages concentrating fire activity in that area. The chevron pattern requires higher skill level to moderate fire activity based on the depth and angle of the chevron.

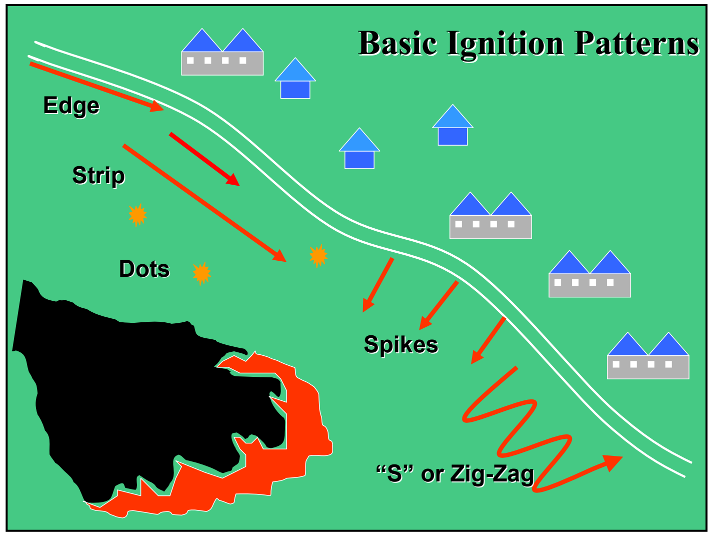


Figure 5.65. Example of various ignition patterns. Not necessarily used at the same time.

Dot Firing

The fire intensity can be increased or decreased depending on the placement, spacing, and number of dot ignition points.

CAL FIRE firefighters no longer use the ring firing pattern to defend structures. Do not light a circular pattern around a structure. If the fire burns toward the center of the ring it damages the structure. If it burns away from the structure it creates uncontrolled head fire. Resources should use a crescent or half moon pattern using an edge or strip firing technique in order to safely manage the applied fire and avoid down wind runs

Figure 5.66. When using the dot firing technique, Individual ignition points are set to interact with each other to achieve any of three applied fire behaviors.

WUI FIRING OPERATIONS

Control Lines and Check Lines

Control lines and check lines are important tools to use when firing around structures. Many structures have been lost through firing operations without the proper lines in place.

Control lines are the locations where firefighters plan to stop the fire spread.

Control lines may include:

- Hand lines or dozer line
- Natural and man made barriers (rivers, roads, areas free of flammable vegetation)

Check lines are temporary open-ended lines used to slow the rate of spread and reduce fire intensity. If control lines are not available for use as anchor points and termination points, check lines should be considered.

Check lines may include:

- Breaks in fuel (lawns, streambeds, rocky areas, parking lots, driveways, and other man made or natural barriers)
- Short sections of hand line
- Wet lines, foam lines, or gel lines
- Retardant drops from fixed wing aircraft
- Water drops from rotary wing aircraft

Holding Operations

After safety, controlling and holding applied fire are the top priorities for any firing operation. Every firing operation requires a holding team to hold the fire on the correct side of the control line, make sure the fire doesn't escape, take action on spot fires, and assist in reducing fire intensity if necessary.

Figure 5.67. Holding and controlling the applied fire is a critical aspect of any firing operation.

A holding team can be a large group of resources (engines, crews, dozers, aircraft, safety officers, field observers, etc.) functioning as a well-organized force or a single engine company firing around a structure. If possible, assemble holding teams before beginning the firing operation, especially for large-scale or complicated planned need operations.

Include the holding team in all briefings. It is critical that the holding team understand the firing operation's objectives and anchor points. The team should know what terrain features and fuel it will be working in and should be aware of all pertinent weather and fire behavior forecasts and the operation's window of opportunity.

The holding team leader should make every effort to scout the firing area before firing begins. Potential problems should be mitigated before conducting the operation. The holding team leader must be in close communication with the firing team leader at all times. Separate tactical frequencies may be required for both the firing team and the holding team. The holding team leader must monitor the firing team's tactical frequency and progress and be prepared for fluctuations in the firing tempo.

The holding team leader should consistently communicate the importance of situational awareness and diligence. Holding operations can be tedious and boring and holding forces can lose their tactical edge if personnel are watching the firing operation rather than watching for potential trouble spots. Crew leaders and company officers must motivate their subordinates to be observant and diligent. Firing is a high-risk operation. Serious injuries and fatalities may occur if firing operations go awry.

At critical areas along the firing route, consider asking air attack to place a dedicated air resource in orbit over the firing operation to support the holding effort. This should only be done for a limited time to avoid removing a valuable resource from the incident operation.

If a *slop-over*, spot fire, or escape occurs, holding forces need to suppress that fire independent of the firing operation. The firing operation may continue even when there are immediate suppression needs elsewhere in the firing area. Slop-overs, spot fires, and escapes are not necessarily a reason to stop a firing operation.

In some cases, discontinuing a firing operation mid course will have adverse consequences on the main fire. In other cases, resources may need to terminate the firing operation in order deal with the escaped fire; continuing to fire may create additional problems.

Slop-Over
Unwanted fire immediately adjacent to an established control line.

The holding team may also be responsible for Tactical Patrol to mop up and secure the applied fire line.

Firing Around a Structure

Firefighters can use the four basic firing patterns and their variations to defend structures when direct attack is not a viable option. The goal is to create additional defensible space around the structure without creating a head fire. This creates a larger burn zone between the main fire and the structure and decreases potential for ignition from radiant heat.

- Scout the area to be fired to identify and mitigate any potential problems.
- Identify anchor and termination points for the firing operation. If natural or constructed barriers are not present, use check lines.
- Brief supervisors, participants (holding team, ignition team, lookouts), and adjoining resources.
- Identify or create control lines (hand line/dozer line, natural or constructed barriers, wet lines applied prior to or after ignition, and retardant lines)
- Prep the structure and the area around it. Remove flammable vegetation and apply foams or gels as needed. Cover openings (doors, windows, vents) and remove flammable furniture and vegetation under and around decks.
- Put firing team, holding team, and safety resources in place.
- Notify supervisors, participants, and adjoining resources that the firing operation will begin.
- Conduct a test burn.
- Begin the firing operation. Start slow, applying only as much fire as needed to meet objectives. Modify patterns as necessary to achieve objectives.
- Utilize holding forces to suppress spot fires and decrease intensity, as necessary.
- Terminate the firing operation if it achieves its objectives or conditions make continued firing undesirable.
- Suppress the applied fire, and mop up and secure the area.

Firing is used primarily with Prep and Defend or Prep and Go. There must be viable safety zones and enough time to complete the firing operation before the fire front arrives. Never allow the ap-

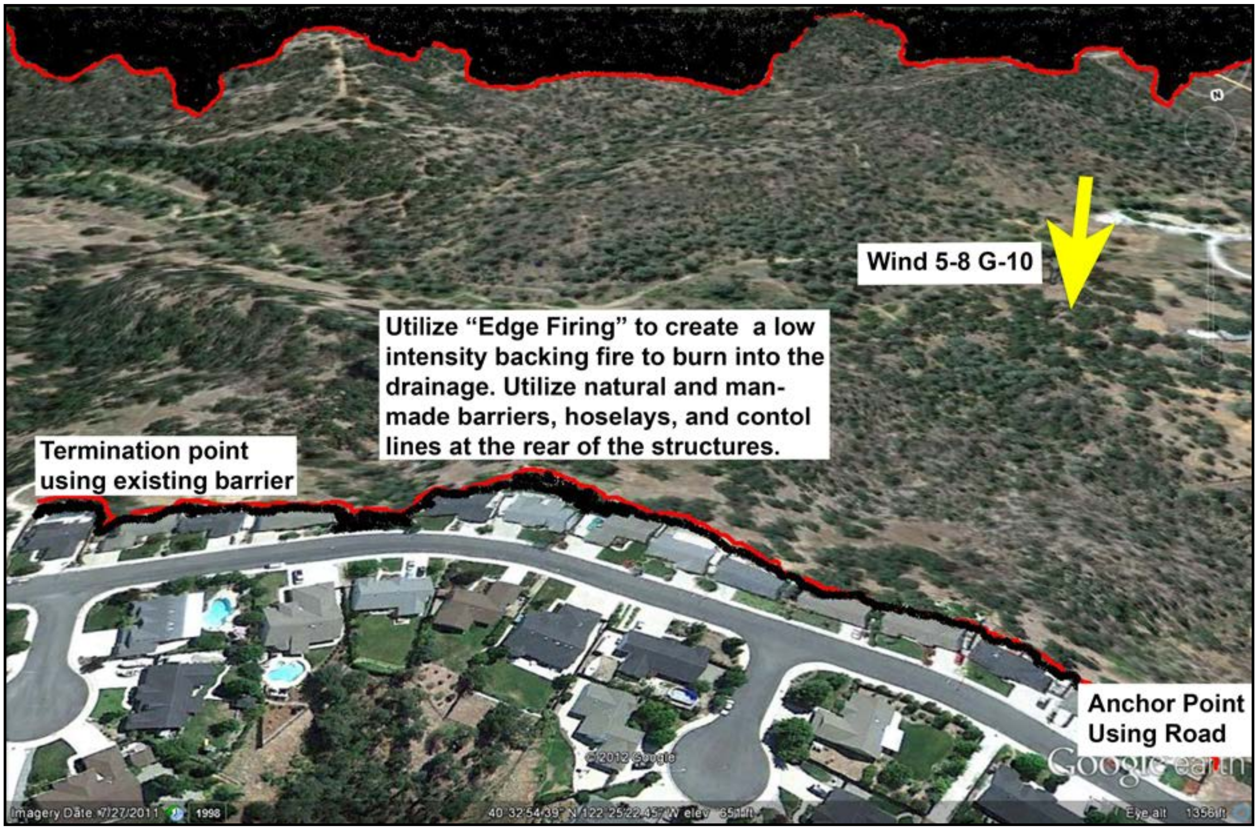


Figure 5.68. Scenario One: Backing Fire

plied fire to burn uncontrolled, threatening other personnel or structures.

Scenario One: Backing Fire

A large fire front is approaching a subdivision that backs up to a green belt. The slope, which the main fire will run up as it hits the structures, falls away from the homes. The main fire will not hit the back of the subdivision for approximately 45 minutes and only have there is only one engine to protect the homes. Applying edge firing along the back of the structures creates a backing fire down the slope creating a buffer zone.

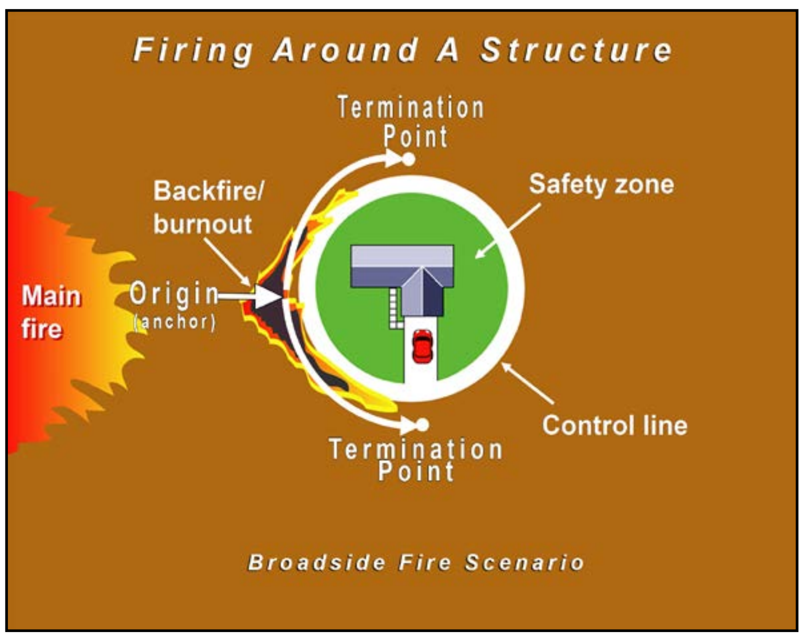


Figure 5.69. Scenario Two: Broadside Fire

Scenario Two: Broadside Fire

A fire is approaching a single-family dwelling with green belt to the rear and right side of the structure. The right side of the structure has flat terrain leading to the drainage where the main fire is established. When the main fire reaches the base of the drainage, it will slope reverse and make an uphill run toward the structure. There are two engines and approximately 30 minutes before the main fire makes its run. By creating check lines to the front and rear of the structure and applying spikes into the influence of the wind in the direction of the main fire, a flanking fire is created. This will allow the safe creation of a large buffer on the fire side of the structure.

Firing Around a Subdivision

Firing around a community or subdivision uses the same strategies as firing around a single structure but requires a higher level of planning, preparation, and resource coordination. Consult the IC, operations section chief, and safety officer before considering a large-scale planned or immediate need firing operation around a community or subdivision.

For a planned need firing operation, develop a written firing plan. For immediate need firing, firefighters should use the Immediate Need Firing Operation Checklist. See appendix page A-8 for the Immediate Need Firing Operation Checklist.

Large-scale firing operations require significant pre-planning. If available, use local pre-plan information to identify water sources, staging areas, control lines, and hazards, and to determine resource needs.

Fire behavior will determine the firing strategy firefighters use to defend a subdivision. Firefighters generally conduct firing operations behind structures, connecting secure natural and constructed barriers with buffer zones to defend structures.

If the fire is backing down a slope toward a subdivision it may be beneficial to not fire and let the fire proceed at a slow pace toward control lines. However, firefighters should be prepared to fire along the control lines to increase the burn zone if the fire intensity increases. In either case, the goal is to keep the main fire from adversely impacting the control line.

Timing is critical. There needs to be enough time to create the burn zone before the main fire reaches that area. At the same time, firefighters should avoid creating unnecessary fire intensity, leading to control problems.

Firing Around Infrastructure

Defending infrastructure is an important management and operational objective in the WUI environment. Some types of infrastructure present unique hazards that suppression resources must be aware of.

Critical infrastructure may include:
- Major power transmission lines and facilities
- Communication equipment and facilities
- Water distribution networks (flumes, canals, sewer, and water treatment)
- Fuel depots and storage areas
- Power generation facilities
- Military installations
- Railroad tracks and signal stations
- Underground pipelines

When perimeter control is not an option, firing operations can be used to defend infrastructure. Along with the four basic firing patterns, firefighters can also use a circular pattern to establish a burn zone. Create a control line all the way around the object, remove ladder fuels, apply foam or gel if needed, and then apply fire 360 degrees around the base. The objective is for the fire to move out and away from the object being defended in a controlled manner without creating new head fires.

Figure 5.70. Thick smoke is an excellent conductor of electricity and provides a pathway to ground for large power transmission lines. Avoid using power line access roads as control lines and avoid firing within 100 feet of large power transmission lines.

Power Grids

Firefighters in the WUI may be required to defend the power grid including power poles, lines, and easements. A maintenance road running underneath power lines should not be used as a primary control line. Use existing roads or construct dozer or hand line a minimum of 100 feet away from the power lines. Smoke is an excellent conductor of electricity and firefighters must avoid power lines impacted by fire or heavy smoke columns.

Before firing around a power grid, coordinate with the utility company to de-energize the lines. This will decrease the possibility of major damage or injury from arcing if the wind shifts or the fire makes a run toward the power lines. Suppression resources should secure power transmission lines as quickly and safely as possible and have them re-energized as soon as it is safe and practical for the power company to do so. Develop a firing plan using low intensity firing techniques to prevent arcing from the power lines to the ground via the smoke column. If power lines cannot be de-energized, firefighters will need to develop alternate and contingency plans.

Cultural, Historical, Endangered, and Sensitive Areas

Firefighters need to be aware of restrictions associated with firing around cultural, historical, endangered, and sensitive areas. Be familiar with these areas and consult the appropriate resource specialists during pre-planning to determine an appropriate action.

CHAPTER 6

RESOURCE UTILIZATION

Competent resource utilization, including the ability to determine the number, configuration, capability, and proper deployment of resources, is a critical component of effective incident command and is absolutely necessary during a WUI incident.

RESOURCE TYPES

There are a variety of resources utilized on WUI incidents. These resource types include engines, dozers, fire crews, aircraft, and support resources. This chapter covers each of these kinds of resources including their capabilities and potential assignment and restrictions on a WUI incident.

MINIMUM ICS STANDARDS - ENGINE

	Engine Type						
	Structure		Wildland				
Requirements	1	2	3	4	5	6	7
Tank minimum capacity (gal)	400	400	500	750	400	150	50
Pump minimum flow (gpm)	1000	500	150	50	50	50	10
Pump @ rated pressure (psi)	150	150	250	100	100	100	100
Hose 2½” (feet)	800	800	-	-	-	-	-
Hose 1½” (feet)	400	400	1000	300	300	300	-
Hose 1” (feet)	200	300	800	300	300	300	200
Ladders (per NFPA 1901)	Yes	Yes	-	-	-	-	-
Master stream (500 gpm min.)	Yes	-	-	-	-	-	-
Pump and roll	-	-	Yes	Yes	Yes	Yes	Yes

Engines

An engine staffed with a well-trained crew is the most versatile resource on the fire ground. An engine delivers water, firefighting and rescue tools, as well as emergency medical equipment. An engine crew may be the first resource to arrive at a WUI incident and the company officer may assume the roll of the initial attack IC. Engine crews may be used in the following ways in WUI firefighting:

- Life safety and rescue
- Fire suppression by mobile attack or extended hose lays
- Structure defense
- Defending man made improvements, historical and archeological sites, and valuable natural resources
- Hot spotting critical areas of the fire line
- Hand line construction

- Supplying water via hose lays, portable tanks, back pumps, or other engines
- Providing emergency medical care to firefighters and civilians

The incident command system (ICS) typing of engines changed in 2012. Minor changes were made to engine types 1, 2, and 3. Significant changes were made to engine types 4, 5, 6, and 7.

Type 3 Engines

For years the philosophy has been that Type 3 engines or wildland engines were only used for perimeter control, while Type 1 engines or structure engines were only used for structure defense. In reality, the primary suppression strategy on a WUI fire should combine structure defense and perimeter control operations.

The Type 3 engine is the preferred engine for WUI incidents because of its design, flexibility, and capabilities. Type 3 engines are capable of extended progressive hose lays, as well as mobile attack, due to their hose complements and pump capabilities. The pumps on Type 3 engines are designed for the high pressures often required for extended hose lays in steep terrain. They can also be used for mobile attack operations, allowing the engine to maintain a charged hose line as it moves along the fire perimeter. Type 3 engines are generally more maneuverable than Type 1 and 2 engines, because of their shorter wheel base and turning radius, higher ground clearance, and off-road capability.

Crew training and experience may vary between wildland agency and municipal agency personnel assigned to Type 3 engines. The personnel on wildland agency Type 3 engines generally work and train together on wildland fire tactics and typically have more experience suppressing wildland fires than municipal fire department personnel. Not all wildland agency firefighters are authorized, trained, and equipped to suppress interior structure fires. However some are capable of performing exterior structure fire suppression. *Structure defense primarily utilizes wildland strategy and tactics until the structure ignites. Fire line supervisors should consider this difference when assigning resources to specific tasks.*

Capabilities and Benefits

- **Maneuverability:** Type 3 engines have a shorter wheel base and many have 4-wheel drive capability. They are more effective in steeper terrain and where there are tight turnarounds.

- **Wildland firefighting tools and hose**: Most wildland agency Type 3 engines carry a compliment of 1½" and 1" hose, as well as portable pumps, wildland firefighting hand tools, and chain saws.

- **Hose lay and hand line construction**: A strike team of Type 3 engines may extend a progressive hose lay with lateral lines over a mile, with tremendous efficiency. The same personnel may be assigned to construct hand line.

- **Versatility:** Many Type 3 engines carry structure firefighting equipment such as 3" supply line, SCBAs, ladders, and EMS/rescue tools, as well as their wildland hose/tool complements.

- **Firing operations**: Type 3 engines should carry firing tools, such as drip torches and fusees, and firefighters should be trained in their use. Type 3 engine crews may also function as an ignition team and/or holding force during firing operations.

- **Structure triage and preparation**: Type 3 engines, if equipped, may pre-treat structures with foams and gels in anticipation of fire front impact.
- **Rescue and evacuation:** Type 3 engines can be used to rescue victims and assist with evacuations in areas where fire front impact is imminent, the roads are narrow, or turnarounds are tight.
- **Mop up and patrol:** Type 3 engines are an excellent tool for mop up and patrol assignments due to their maneuverability, tools, and hose complements.

Tactical Application

TACTICAL APPLICATION OF TYPE 3 ENGINES IN THE WUI	
Check and Go	Maneuverability allows Type 3 engines to access remote structures over a wide area and perform rescue operations if needed.
Prep and Go	Type 3 engines are usually staffed with a minimum three firefighters who can help create defensible space around structures and treat structures with foams or gels, disengaging (if necessary) prior to fire front impact.
Prep and Defend	Type 3 engines provide water, equipment, and trained personnel to prepare and defend structures before and during fire front impact.
Bump and Run	This fast-paced tactic demands the agility and maneuverability of Type 3 engines in order to move with, and ahead of the fire front and help in perimeter control operations.
Fire Front Following	Type 3 engines and crew are ideal for maneuvering behind the fire front, defending structures, suppressing structure fires, hot spotting, and taking perimeter control action.
Anchor and Hold	Type 3 engines can be used for this tactic when high-volume fire streams are not required.
Connect the Dots	Type 3 engines have the versatility to alternate between structure defense and perimeter control, tying sections of secured line together.
Tactical Patrol	Although Type 3 engines are well-suited for Tactical Patrol, this may not be the best assignment for a Type 3 engine. Consider the amount of perimeter control efforts requiring Type 3 engines before committing these resources to Tactical Patrol.

Type 1 and 2 Engines

Type 1 and 2 engines, while often requested and used during WUI incidents, are not as well-suited for WUI incidents as Type 3 engines. Their large size and lack of maneuverability and off-road capability are not ideal for rural areas. These engines may lack basic wildland firefighting tools, such as single jacket hose, hand tools, and basic firing devices. While Type 1 and 2 engines do have a role in WUI operations, firefighters need to have a good understanding of their capability and limitations. Type I and 2 engines are staffed by firefighters trained and equipped for structural firefighting but not always trained and experienced in wildland fire behavior and defending structures using wildland fire suppression techniques.

Operational overhead must consider the strategies and tactics for the mission and then assign the most appropriate resource for the tasks. In subdivisions where hydrants and paved roads are common, or in rural areas with well-maintained roads, Type 1 and 2 engines can be a valuable resource. They can be used to support Type 3 engines or combined with Type 3 engines in a task force for maximum impact.

Type 1 and 2 engines can be used as a holding force during firing operations and patrol around structures after the fire front has passed. This is a vital function as many structures surviving the fire front may be destroyed by residual burning after the fire front passes. Their personnel can use their structural firefighting capability to attempt to minimize damage to structures and perform salvage, mop up and overhaul tasks. They can also assist with hose lays and hand line construction. When ingress and egress are safe for Type 1 and 2 engine access, these engines can be an effective resource for structure triage, structure preparation, structure defense, and evacuations. Scout access routes prior to committing Type 1 and 2 engines.

Figure 6.1. Type 1 and Type 2 engines, though not usually outfitted for WUI incidents, play an important role in structure defense and perimeter control.

Capabilities and Benefits

- **Wildland firefighting tools and hose**: Type 1 and 2 engines should maintain a basic complement of wildland firefighting equipment including: 1½” single jacket and 1” hose, wildland hose clamps, hose tees, nozzles, hand tools, and firing devices.
- **Hose lay and hand line construction**: Type 1 and 2 engines may be used for hose lays and hand line construction, if properly equipped and staffed with personnel trained for these tasks.
- **Structure triage and preparation**: May have the ability to pre-treat structures with foams and gels and provide defensible space on roadways and driveways.
- **Firing operations**: Type 1 and 2 engine crews can provide an effective holding force during firing operations, assisting in controlling spot fires and flare ups.
- **Rescue and evacuations:** Type 1 and 2 engines are suited for rescue and evacuations if maneuverability is not an issue.
- **EMS:** Many are staffed and equipped for basic life support (BLS), but may also have advanced life support (ALS) capability.
- **Mop up and patrol**: Type 1 and 2 engines should be considered for mop up and patrol, especially Tactical Patrol, freeing up the more versatile Type 3 engines for other tasks.

Figure 6.2. In rural areas with paved roads or well maintained dirt roads, Type 1 and Type 2 engines are capable of taking direct perimeter control action and supporting other wildland resources.

Tactical Application

TACTICAL APPLICATION OF TYPE 1 AND 2 ENGINES IN THE WUI	
Check and Go	Narrow or steep driveways and structures with inadequate turnarounds are of particular concern and should be scouted prior to committing Type 1 and 2 engines to Check and Go.
Prep and Go	Type 1 and 2 engines are usually staffed with a minimum three firefighters who can help create defensible space around structures and treat structures with foams or gels, retreating (if necessary) prior to fire front impact. Driveways should be scouted prior to entry.
Prep and Defend	Type 1 and 2 engines provide water, equipment, and trained personnel to prepare and defend structures before and during fire front impact.
Bump and Run	This fast-paced tactic requires agility and maneuverability, often in off-road situations, and is not typically well suited for Type 1 and 2 engines. Type 1 and 2 engines may be suitable for this tactic if an adequate road system or adequate off-road conditions are present.
Fire Front Following	Type 1 and 2 engines are well suited for this tactic where activities are often conducted behind the fire front, allowing personnel to mitigate the aftermath of the fire passing through structures and infrastructure.
Anchor and Hold	Type 1 and 2 engines are a good resource for this tactic because of their hose complement, pump capacity, fire fighting tools, and structural firefighter capability. They are an ideal platform to conduct high-volume fire stream operations.
Connect the Dots	Type 1 and 2 engines have the ability to tie sections of secured line together between structures, roads, and control lines. They can also hot spot and should conduct mop up activities to secure line.
Tactical Patrol	Type 1 and 2 engines are ideal for Tactical Patrol unless roadways and driveways prohibit entry or maneuverability.

Type 4, 5, 6, and 7 Engines

These engines are smaller and more maneuverable than Type 1, 2, and 3 engines. Except for type 4 engines they do not carry as much water, equipment, and hose but are still a viable option for WUI firefighting. These engines have lower-volume, higher-pressure pumps and fewer personnel. They are relatively flexible in the WUI environment and can conduct both structure defense and perimeter control.

Figure 6.3. Type 5, 6, and 7 engines with their short wheel base can negotiate narrow, windy roads and access areas of the fire inaccessible to larger engines.

Both fire agencies and private contractors use these engine types. The engine crew's training, experience level, equipment, and policy constraints may dictate its assignments and limit its use.

Capabilities and Benefits:

- **Maneuverability**: These engines have a shorter wheel base and many have 4-wheel drive capability. They are more effective in steeper terrain and where there are tight turnarounds.

- **Wildland firefighting tools and hose**: These engines have limited hose and equipment capacity.
- **Hose lay and hand line construction:** These engines can construct hose lays but may be limited by pump capability and the amount of hose they carry. The personnel are equipped and trained for hand line construction.
- **Firing operations:** These engines should carry firing tools, such as drip torches and fusees, and firefighters should be trained in their use.
- **Structure triage and preparation:** They have the ability to access narrow driveways and conduct limited structure defense preparation. However, their limited crew size and tool complements may limit their abilities.
- **Rescue and evacuations:** The crew may or may not be trained or equipped for EMS support. However, they are very maneuverable and can access and turn around in narrow or tight areas with little difficulty.
- **Mop up and patrol:** This is a good application for Type 4, 5, 6, and 7 engines, freeing up other resources for more critical assignments.

Tactical Application

TACTICAL APPLICATION OF TYPE 4, 5, 6, AND 7 ENGINES IN THE WUI	
Check and Go	If adequately trained and equipped, Type 4, 5, 6, and 7 engines may perform this tactic with success.
Prep and Go	If adequately trained and equipped, Type 4, 5, 6, and 7 engines may assist with this tactic. Crew size may be a limiting factor. It may take multiple resources to prepare one structure.
Prep and Defend	Depending on the fire behavior, Type 4, 5, 6, and 7 engines may be adequate for certain Prep and Defend actions. Crew size may be a limiting factor. It may take multiple resources to prepare and defend one structure.
Bump and Run	These engines are an excellent resource for this tactic. Crew size and water capacity may be a limiting factor.
Fire Front Following	These engines may be capable of conducting this tactic. Water supply, structural firefighting equipment, and structure suppression training may be a limiting factor.
Anchor and Hold	These engines are not well-suited for this tactic. They have inadequate pumps, water capacity, and hose supply.
Connect the Dots	These engines have the versatility to alternate between structure defense (if properly trained and equipped) and perimeter control, tying sections of secured line together.
Tactical Patrol	This is an ideal application for these highly-mobile engines.

Engine Preparation and Equipment Requirements

Engine preparation is critical on all types of incidents. This is especially true of WUI incidents where the situation can change rapidly. Before entering the fire area make sure the engine if fully prepared to enter the WUI environment.

- Secure the engine against ignition (close the doors, roll up the windows, remove combustibles from the exterior, cover hose beds).
- Deploy hose on the WUI hose brackets (if so equipped).
- Identify an engine protection line.
- Set tactical and command channels on mobile and portable radios.

- Remove unnecessary tools and equipment from the compartments.
- Ensure all firefighters are wearing all necessary PPE.
- Check water tank level.
- Test the pump, hose, and nozzle to make sure they work.

The minimum hose diameter should be 1½" for a WUI incident. Hose lines for structure defense should correspond in number and length to the needs of the current assignment. A single hose line allows firefighters to remain together and assist each other with deploying and maneuvering the hose line, enhancing communication and simplifying accountability. When defending large structures or multiple structures, more lines may be needed. Deploy only as much hose as needed to fulfill the assignment. The longer the hose line, the less agility firefighters have, impacting tactical maneuver. Combination nozzles with adjustable flow settings should be the rule; however, in strong wind conditions tips may be necessary because they offer greater reach. Nozzle settings should be set at minimum of 50 gpm so as to provide an effective fire stream to suppress the fire while keeping in mind water conservation.

For enclosed cab fire apparatus, a charged engine protection line may not be necessary. Engines with exposed crew compartments should maintain a readily-accessible, charged 1½" hose line for crew protection.

Engine companies should be prepared to engage in structure defense using only the water available on the engines. Take every opportunity to fill water tanks using:

- Hydrants or risers
- Water drafted from ponds, creeks, pools, and other static water sources
- Fixed water tanks around structures
- Water tenders
- Domestic water supply (garden hoses)

Keep supply line length to a minimum. Position water tenders with easy engine access in mind. Leave a short supply line attached to hydrants to reduce fill time for all resources. Always try to maintain a minimum of 100 gallons of water in the tank for engine and crew protection.

Fire Crews

Fire crews are organized, trained, and equipped to work together and perform a variety of tasks on WUI incidents including perimeter control and structure defense. They contain their own supervision and radio communications. Crews vary in size and configuration. They are classified by their capabilities and restrictions.

Figure 6.4. Fire crews are a versatile resources on a WUI incident, capable of perimeter control and structure defense tasks.

Crews can be organized as a single resource (one crew), strike teams (multiple crews), or task forces (multiple resource kinds and types). Once a crew is committed it may not be rapidly moved or reassigned. It takes time for fire crews to return to their vehicle for relocation.

When conducting perimeter control operations, crews may construct hand line, assist with hose lays, conduct firing operations, mop up, patrol, assist with fire line suppression repair, and be a general labor source.

During structure defense operations, crews usually prep around structures, construct control lines, conduct firing operations, assist in evacuations, conduct direct suppression activities (hot spotting, patrol and take action on spot fires), and assist engine companies.

Figure 6.5. Fire crews can construct, fire, hold and mop up perimeter control lines.

When fire crews support engine companies, they may perform the full spectrum of wildland engine company activities, such as carrying and deploying hose in support of hose lays, working lateral hose lines during mop up/holding operations, and structure preparation to improve defensible space, such as:

- Removing fencing that may impede suppression action or escape routes
- Removing flammable material around structures, propane tanks, etc.
- Removing wood piles, lawn furniture, and any other flammable item
- Constructing hand line around structures
- Firing operations including ignition and holding actions

When using CAL FIRE/CDCR crews, the Fire Crew Captain may need to request additional support from the California Department of Corrections and Rehabilitation (CDCR) to supervise these crews around structures and provide accountability.

Type 1 Fire Crews

Type 1 fire crews:

- Have the highest level of training and experience
- Are fully mobile and equipped
- Have permanently assigned supervision
- May have specialty skills such as firing or timber felling
- May be split into squads or teams as supervision allows
- Are well equipped for most long duration assignments
- Typically have a higher production rates than Type 2 crews
- In California include:
  - Federal Hot Shot crews
  - CAL FIRE/CDCR crews
  - Local government fire crews
  - Contract county fire crews

Tactical Application

TACTICAL APPLICATION OF TYPE 1 FIRE CREWS IN THE WUI	
Check and Go	Type 1 fire crews are not suited for this tactic, but may be used in emergency situations. Training and experience may be limiting factors.
Prep and Go	Type 1 fire crews are very useful when preparing structures for fire front impact. Due to lack of mobility, consider reflex time when re-deploying crews.
Prep and Defend	Type 1 fire crews are an excellent resource for this tactic when supporting engine companies assigned to structure defense. In common neighborhoods, crew members may form two- or four-person teams working with individual engines to defend multiple structures. They can help staff hose lines, suppress spot fires, enhance defensible space, construct hand line, and conduct firing operations around structures.
Bump and Run	Type 1 fire crews may be helpful for this tactic when fire behavior conditions do not necessitate a hasty retreat from the tactical area. Fire crews are more effective for Bump and Run when structures are close together so that crews do not lose time loading and unloading or hiking between structures. Type 1 crews are particularly effective at hot spotting around structures and along perimeter control lines. Consider Type 1 crews for coordinated firing operations and perimeter control activities.
Fire Front Following	Type 1 fire crews should be considered for this tactic in a support role for engines working behind the advancing fire front to hot spot, suppress spot fires, and construct control lines where necessary.
Anchor and Hold	Type 1 fire crews may have a limited role during this tactic. They can be used to staff hose lines, suppress spot fires, and patrol neighborhoods.
Connect the Dots	Type 1 fire crews are effective for this tactic. They can be used to construct control lines, mop up, conduct firing operations, and assist with hose lays.
Tactical Patrol	Type 1 fire crews can be effective for this tactic. They can secure open line, assist in mop up, and mitigate hazardous conditions. However, Type 1 crews are better utilized for perimeter control operations or more specialized tasks.

Type 2 Fire Crews

Type 2 fire crews:

- May or may not be utilized on hot line assignments, structure defense, or for firing operations due to use restrictions
- Have less training and experience than Type 1 crews
- May be used for structure pretreatment and preparation and to construct control lines when safe to do so
- May not have full time crew transportation, issued radios, or the logistics required to support them in the WUI environment
- Have less supervision than a Type 1 crew and that supervision may not be permanently assigned
- May lack crew cohesion as they may not have worked together prior to the fire assignment

Check Type 2 fire crew qualifications prior to an assignment.

Tactical Application

TACTICAL APPLICATION OF TYPE 2 FIRE CREWS IN THE WUI	
Check and Go	Type 2 fire crews are not usually used for this application, but may be used in emergency situations. Training, experience, and supervision may be limiting factors.
Prep and Go	Type 2 fire crews are very useful when preparing structures for fire front impact. Due to lack of mobility, consider reflex time when re-deploying crews.
Prep and Defend	If trained and qualified for hot line use, Type 2 fire crews can be used for this tactic when supporting engine companies assigned to structure defense. In common neighborhoods, crew members may form two- or four-person teams working with individual engines to defend multiple structures. They can help staff hose lines, suppress spot fires, enhance defensible space, construct hand line, and conduct defensive firing operations around structures. Some Type 2 crews are not qualified to carry out this tactic.
Bump and Run	If trained and qualified for hot line use, Type 2 fire crews may be helpful for this tactic when fire behavior conditions do not necessitate a hasty retreat from the tactical area. Fire crews are more effective for Bump and Run when structures are close together so that crews do not lose time loading and unloading or hiking between structures. Type 2 crews are particularly effective at hot spotting around structures and along perimeter control lines. Consider Type 2 crews for coordinated firing operations and perimeter control activities. Some Type 2 crews are not qualified to carry out this tactic.
Fire Front Following	If trained and qualified for hot line use, Type 2 fire crews should be considered for this tactic in a support role for engines working behind the advancing fire front to hot spot, suppress spot fires, and construct control lines where necessary. Some Type 2 crews are not qualified to carry out this tactic.
Anchor and Hold	If trained and qualified for hot line use, Type 2 fire crews may have a limited role during this tactic. They can be used to staff hose lines, suppress spot fires, and patrol neighborhoods. Some Type 2 crews are not qualified to carry out this tactic.
Connect the Dots	Type 2 fire crews can be effective for this tactic. Depending on use restrictions, they may be used to construct control lines, mop up, conduct firing operations, and assist with hose lays.
Tactical Patrol	Type 2 fire crews can be effective for this tactic. They can secure open line, assist in mop up, and mitigate hazardous conditions.

Dozers

In the WUI environment, dozers can:

- Perform perimeter control actions
- Construct control or check lines
- Develop or expand safety zones and temporary refuge areas
- Improve defensible space around structures or communities
- Improve access and egress to and from structures
- Support firing operations

Dozers should be coordinated with engines and hand crews to maximize their efficiency.

When there are multiple dozers assigned to an incident, it may be advantageous to utilize them in pairs, recognizing that there will be many situations where the dozers may be separated or working in two different directions from a common anchor point. This tactic may increase line production and may create opportunities to change from a defensive to an offensive strategy by taking advantage of terrain and natural barriers.

Teaming an agency dozer with a private dozer can increase efficiency, accountability, and safety for both dozers. Per CAL FIRE policy 7761, private (hired) dozers on the fire line must have direct supervision and coordination at all times. Using private equipment in the WUI is much like using Type 2 fire crews. The equipment and qualifications must be inspected and reviewed prior to an assignment.

Dozers can be very destructive to property and infrastructure. Firefighters should weigh the consequences before assigning dozers. For example, in common neighborhoods, dozers may damage fences, roads, trees, water lines, and other infrastructure. When dozers are necessary, include suppression damage and repair in the overall incident plan.

Figure 6.6. Dozers should coordinate their efforts with other resources to maximize their efficiency..

When working with dozers, scout the area for dozer traps such as mines, bridges, septic tanks, propane tanks, above-ground fuel tanks, underground fuel pipe lines, exposed water pipes or hydrants, utility poles, swimming pools, and any other item that could compromise a dozer. This is especially important when dozers are working in a fire area under impaired visibility or at night.

Dozers can be used as a single resource or configured into groups, strike teams, or as part of a task force. Dozers and fire crews work well together. Direct communication between fire crew supervisors and dozer operators is vital because of the added risks present when fire crews work in tandem with dozers.

Tactical Application

TACTICAL APPLICATION OF DOZERS IN THE WUI	
Check and Go	Dozers are not suitable for this tactic.
Prep and Go	Dozers may be used to construct line and create additional defensible space around structures before fire front impact. Due to lack of mobility, consider reflex time when assigning dozers to this tactic.
Prep and Defend	Dozers are useful for constructing line around structures prior to fire front impact and may also construct line around large spot fire areas near isolated structures. Dozers may be used to construct temporary refuge areas or safety zones near structures. As opportunities arise, dozers may alternate between structure defense preparation and perimeter control.
Bump and Run	Dozers can augment engines that utilize this tactic by assisting with perimeter control efforts and constructing control lines around structures. Due to extended reflex times to load and unload, dozers are not considered a primary Bump and Run resource.

TACTICAL APPLICATION OF DOZERS IN THE WUI	
Fire Front Following	Dozer applications are limited to constructing line around structures threatened by fire.
Anchor and Hold	Dozers are not suitable for this tactic.
Connect the Dots	Dozers are very well suited for connecting open line to secured areas in the WUI environment.
Tactical Patrol	Dozers should be available to assist engine companies should the need arise.

RESOURCE CONFIGURATION

The three ICS resource configurations are single resource, strike team, and task force. Firefighters must understand the advantages and disadvantages of each configuration.

- **Single Resource**: An individual piece of equipment, its personnel and tool complement; an organized crew or team of individuals with an identified work supervisor. Example: an engine company, a fire crew, a dozer. Single resources are typically dispatched for initial attack as well as subsequent alarms. When span of control becomes an issue, single resources may be organized into incident-formed strike teams and task forces, reducing the span of control.

- **Strike Team**: Specified combination of the same kind and type of resources, with common communications and a leader. Example: a Type 1 engine strike team (five Type 1 engines and a leader), a Type 1 fire crew strike team (minimum 27 personnel including a leader), a Type 2 dozer strike team (two Type 2 dozers, one dozer tender, and a leader).

- **Task Force**: A group of unlike resources with common communications and a leader, that may be pre-established and sent to an incident, or formed at an incident, to perform a specific task. Example: three Type 1 or Type 2 engines, two Type 3 engines, one water tender, and a leader.

A Strike Team Leader or Task Force Leader may report directly to the IC on an initial attack incident. As the incident organization expands, they may report to a division or group supervisor as directed by the IC. The strike team or task force leader is responsible for performing tactical assignments in a geographical or functional area. The strike team or task force leader reports work progress and resource status, maintains work records, relays important information and intelligence to the line supervisors, and coordinates activities with adjacent strike teams, task forces, and single resources. Strike team and task force leaders may assist division supervisors with geographic line supervision when there is a critical need for supervision and intelligence gathering.

Figure 6.7 Strike team and task force leaders usually check in with the IC at the ICP for briefings and assignments on initial attack and extended attack incidents.

Strike Teams

Strike teams are a common resource configuration ordered for extended attack and major incidents. Strike teams typically form in their home unit, department, or operational area. Strike teams may also be ordered to form at the incident. However, strike team single resources arriving at the incident at different times may increase span of control problems.

No matter the kind or type of resource being ordered in strike team configuration, how the strike team is ordered is as important from the standpoint of reflex time, the time it takes the resource to deploy on the incident after it's ordered. When a strike team is assembled , it does not leave the home unit or administrative area until the last engine arrives at the rendezvous point, prolonging reflex time. If the strike team is ordered as a planned need resource for the next shift or coverage for empty fire stations, reflex time is usually not a factor. If the strike team is ordered as immediate need, prolonged reflex time is a disadvantage for the IC.

If strike teams are ordered to form at the incident, reflex time is reduced, however, this does pose a span of control problem when individual resources of the strike team arrive at different times at the incident. Incident commanders and line supervisors will have to supervise the single resources until the strike team leader arrives. Deploying the single resources of the strike team in the same geographical division will help the strike team leader account for and assume supervision of the strike team after arriving at the incident.

Figure 6.8. How a strike team is ordered will affect when it arrives at the incident.

Engine Strike Teams

Engine strike teams, in particular Type 3 strike teams, may be one of the most versatile resources on an incident. With a minimum staffing level of 16 personnel, including the strike team leader, Type 3 strike teams may be formed into a fire crew for hand line construction or other typical crew activities. Individual single resources of the strike team may perform different functions within their assigned area. For example, two engines may defend structures while three engines engage in perimeter control; the strike team may be split and deployed to different areas of the geographical division.

Figure 6.9. Type 1 and Type 2 engines, when properly configured for WUI incidents, are capable of most of the tactical actions associated with WUI fire suppression.

Unlike Type 1 and 2 engine strike teams, Type 3 engine strike teams generally arrive at an incident prepared for wildland firefighting. Personnel have received specialized training in WUI and other wildand tactics and the engines are more likely to be outfitted with appropriate wildland tools, hose and support equipment.

Type 3 engine strike teams are highly maneuverable and are well suited in cramped WUI conditions. Many Type 3 engines are also four wheel drive allowing them to perform in off road or steep terrain situations. Drive ways and turn-arounds in the WUI may be narrow and winding, Type 3 engine are better suited for this problem. Type 1 and 2 engines are well suited for these areas but require more time to position themselves at a target structure and may be unable to safely access some structures.

Type 1 and 2 engine strike teams are a welcome resource on any WUI incident. In certain areas of the state, Type 1 and 2 strike teams are readily available in large numbers from local government departments. Type 1 and 2 engines are considerably larger and less maneuverable than their Type 3 counterparts and as a result are more limited in their deployment options. Like Type 3 engine strike teams, Type 1 and 2 engine strike team personnel may be formed into fire crews to perform typical fire crew functions. Type 1 and 2 engine strike teams may also be split to perform various functions within their assigned area. Wildland tactical training for Type 1 and 2 engine crews may be limited and as a result there may be some limitations regarding their deployment. Incident Commanders and fire line supervisors must ensure that Type 1 and 2 strike teams are deployed within their scope of training and capability.

Fire Crew Strike Teams

A fire crew strike team consists of a group of like resources with a minimum of 27 personnel (including crew members, supervisors, and a strike team leader). Strike teams can be all Type 1 crew members or all Type 2 crew members but not a combination of the two. Some fire crew strike teams may have multiple support vehicles. This may increase efficiency by splitting up crew assignments and covering a wider area but it can also create additional traffic congestion in the tight confines of the WUI environment.

Fire crew strike teams are a valuable resource in the WUI, capable of supporting engines and dozers, conducting firing operations, preparing structures for defense, and taking direct perimeter control action. Though known for their ability to construct hand line, fire crews are well suited to support a hose lay because of their ability to move large amounts of hose over long distances, freeing up engine crews normally assigned this task. Fire crew strike teams may be split and assigned to different locations within their geographic division to perform different tasks.

Fire crews have been under utilized for structure defense preparation on WUI incidents. Because of the number of personnel in a fire crew strike team, structure preparation efforts are greatly enhanced when fire crews assist with the task. Fire crews are capable of quickly moving piles of fire wood, lawn furniture and

Figure 6.10. Control line construction in rugged terrain is the mainstay of the Type 1 fire crew.

other flammable objects away from structures; they can construct hand line around structures and conduct firing operations to secure the control lines; they can remove excess vegetation surrounding a structure.

Historically, hand line construction in difficult terrain is the bench mark of fire crew performance capability. With that in mind, and unless contraindicated, perimeter control efforts should take priority over structure preparation and defense when deploying fire crews on a WUI incident. Standard tactics would apply for crews assigned to perimeter control on WUI incidents. Strike team leaders must maintain close communication with their fire line supervisor to ensure that suppression and defense actions are coordinated and do not compromise safety.

Dozer Strike Teams

Dozer strike teams are composed of 2 dozer/transport units plus their support vehicles and the strike team leader. Dozer use on WUI incidents has certain limitations due to the size and maneuverability of the dozer transport. Of critical concern when assigning dozers is access to the incident area or geographical division. Dozer strike team leaders must ensure that ingress and egress are not compromised by dozer transports trying to access the incident.

Dozers are valuable tools for perimeter control and limited structure defense preparation tasks. Dozers can quickly and efficiently perform the Connect the Dots tactic, connecting portions of the perimeter that have been contained, in order to create a continuous control line. Dozers should be supported by fire crews and/or engines whenever possible for maximum effect. As a dozer constructs control line, fire crews may burn out from the line while engines support and hold the firing operation.

Structure defense preparation with dozers is limited to control line construction around individual structures or groups of structures. When the line is completed, fire crews or engine personnel may burn out from the line. Obviously, great care must be taken by dozer operators when working around structures. The potential for damage to the structure, its infrastructure or grounds must be minimized by using a dozer swamper.

Figure 6.11. Dozers are best suited for direct and indirect control line construction over long distances.

A vital function for dozers is constructing safety zones or improving temporary refuge areas. This task should be reserved for more isolated WUI areas where an abundance of wildland separates individual structures or groups of structures, limiting the potential damage to yards and landscaping.

Task Forces

The taskforce concept is under utilized in wildland firefighting and especially in WUI firefighting. A taskforce should be considered as a specialized unit assembled for specific tasks, and their applications are almost limitless. Within a geographic division, all suppression actions are supervised by the Division Supervisor. Supervision conflicts are eliminated by assigning task forces to divisions for structure defense rather than assigning structure groups to geographic divisions.

The task force is an effective resource configuration for WUI incidents. It allows resources to complement each other capitalizing on their different capabilities. For example, Type 1 engines can be used for structure defense while Type 3 engines construct a hose lay for perimeter control around the same structure. A water tender provides a water supply for both types of engines. A crew simultaneously constructs a control line around the structure and assists with structure defense preparation, all as part of the same task force.

WUI Task Forces

A WUI task force should be formed to meet the demanding and specific needs of a WUI incident. A WUI task force offers support and greater flexibility to the individual single resources in the task force. If a group of structures has been classified as threatened defensible, a WUI task force can enter the area and perform multiple tasks at the same time reducing structure defense preparation time and greatly enhancing the defense effort.

Example of a WUI structure defense task force :

- 1 – Task force leader
- 3 – Engines (could be multiple types)
- 1 – Water tender (any type)
- 1 – Dozer (any type)
- 1 – Fire crew (Type 1 or 2 depending on incident or assignment complexity)

Example of a firing task force:

- 1 – Task force leader
- 2 – Engine strike teams
- 2 – Single resource crews
- 1 – Dozer (any type)
- 1 – Water tender (any type)

Example of a Specialized task force such as gel, foam or CAFS:

- 1 – Task force leader
- 3 – Gel, foam, CAFS tender
- 1 – Water tender
- 2 – Engines (appropriate type for the assignment)

Forming single resources into a task force under the supervision of a task force leader increases supervision and accountability while reducing span of control. This is particularly effective during initial attack and extended attack incidents. Task forces can be ordered as part of a consolidated resource order.

49 Fire (Auburn, CA) - August 2009

During this rapidly developing WUI fire in Auburn, California, the task force concept was used with success. The fire was moving so fast that the IC ordered multiple "any type" engines along with corresponding numbers of overhead. As the engines arrived, they were quickly formed into task forces and assigned. This reduced span of control and afforded the IC accountability and control.

Aircraft

Aircraft are a valuable resource, significantly enhancing firefighting operations and improving safety in the WUI environment. Firefighters should possess a working knowledge of aircraft capabilities and limitations in order to properly deploy and utilize fixed and rotary wing aircraft.

Aircraft have different limitations than other resources:
- They may not be safe to fly in gusty or erratic winds, or when wind speeds exceed 30 mph
- They may be limited by visibility
- They must avoid aerial hazards (tall towers, wires, trees, terrain, other aircraft)
- They are subject to malfunctions and maintenance needs, occasionally limiting their availability
- They are subject to flight time restrictions
- Their drops may be restricted by the presence of civilians, incident resources, and hazards on the ground
- They cannot drop within 300 feet of waterways unless there is a threat to life
- Their drops become less effective as wind speed increases
- They may be diverted to a new incident at any time

Any portions of the IAP that depend on aircraft must have an alternate and contingency plan in place. *Do not depend on aircraft to ensure firefighter safety.*

Figure 6.12. Fixed wing aircraft retardant drops are capable of slowing fire spread over large sections of fire perimeter, defending subdivisions and communities, and pre-treating control lines for firing operations.

A good analogy for aircraft utilization is to use helicopters like engines and use air tankers like bulldozers. Much like engine companies, helicopters are excellent for direct suppression of active fire line. Similar to bulldozers, air tankers are excellent for constructing indirect line just ahead of the fire, allowing the fire to burn into the retardant line.

Communications with ATGS

The Air Tactical Group Supervisor (ATGS) is an important resource on a WUI incident. The ATGS' primary responsibility is the safety of all aircraft over the incident including air space

separation and coordination. Assisting ground personnel, the IC, or Operations Section staff is a secondary responsibility. The ATGS can provide intelligence, feedback, and communication support.

Several critical communications must occur between the IC and the ATGS early in the incident, including:

- Fire area access
- Fire orientation
- Size up, threats, and priorities
- Establishing operational objectives
- Developing an incident action plan
- Ordering additional aircraft
- Identifying communication frequencies
- Evaluating the effectiveness of the incident action plan

Figure 6.13. The ATGS can see what the fire has done, what it is doing now, and what it will do in the immediate future, as well as advise the IC on possible strategies and tactics.

Fire Orientation

In a dynamic, fast moving fire incident, orientation may be confusing. It is imperative that the IC and ATGS have the same orientation to the fire. Utilize parts of the fire and topographic features to describe orientation rather than cardinal direction.

Size Up, Threats, and Priorities

The ATGS should paint for the IC and Operations personnel a mental picture of what the incident has done, is doing now, and may do over the next several minutes and hours. This description should include: the type of vegetation burning, the types of vegetation in the fire front path, the current rate and direction of spread and whether or not it may change in the immediate future, the topography the fire is burning in, major topographical changes in the fire front path, the potential for wind and slope or drainage alignment, and any structures, critical infrastructure, or values at risk in the fire path. Because the ATGS has an aerial view, he or she can also assist in setting incident priorities.

Operational Objectives

The IC should communicate the operational objectives to the ATGS, along with the priorities for tactical action. The IC's leader's intent gives the ATGS an opportunity to provide input and develop the air tactical portions of the incident action plan (IAP). The IC should consider communicating leader's intent and incident objectives to the ATGS over the incident's command frequency. This allows the Emergency Command Center (ECC), Geographic Area Coordination Center (GACC), and other resources responding to, or engaged in, the incident to hear the information.

Ordering Additional Aircraft

The IC and ATGS must agree on the aircraft ordering process. Will aircraft orders originate with the IC or will the IC authorize the ATGS to place aircraft orders to meet the incident's operational objectives? In either case, it is important for the ATGS to update the IC of aircraft status throughout the incident in order to avoid confusion or duplicate orders. On WUI incidents, due to workload and span of control, the IC often delegates the aircraft ordering process to the ATGS.

Figure 6.14. The IC and ATGS must agree on the aircraft ordering process for the incident. The aircraft ordering is often delegated to the ATGS who will communicate orders and priorities to the IC for documentation.

Identifying Communication Frequencies

The IC, operations personnel, and ATGS must identify a frequency to establish immediate radio communications in times of critical need. The assigned air-to-ground or the command frequency may be utilized as a primary contact between the ATGS and command personnel. Keep in mind that the air-to-ground frequency will also be used by all incident resources and will likely be congested. Avoid using tactical frequencies for aircraft communication after the initial brief between the IC and ATGS, both parties should agree on the primary frequency that will be utilized to hail the IC and ATGS. Chasing around on different frequencies on a WUI incident is time consuming and inefficient.

Helicopters

Helicopters are well suited for:
- Hot spotting fire in support of hose lays, fire crews, or dozers constructing control lines
- Recon and mapping missions
- Moving personnel and supplies
- Medivac and rescue missions
- Dropping water, foam, and retardants
- Aircraft coordination
- Aerial ignition

Helicopters are categorized by their size and capabilities.

ICS MINIMUM STANDARDS - HELICOPTERS			
COMPONENTS	TYPES		
	1	2	3
Seats (including pilot)	16	10	5
Card weight capacity (lbs)	5000	2500	1200
Gallons	700	300	100
Examples	Bell 214, S-61, S-64	Bell 204, 205, 212, 412	Bell 206, A Star

When ordering helicopters, firefighters should weigh the task to be performed against the helicopter's capabilities. A Type 2 helicopter is the most versatile air asset for water drops and personnel shuttles. Some Type 1 helicopters are restricted to water drops and cannot shuttle personnel. Others are approved to do both. Type 3 Whelicopters are excellent resources for recon and mapping missions. They can shuttle personnel and drop water, but are limited by their size and capability.

Many fire and law enforcement agencies have helicopters available for WUI operations. These aircraft and flight crews must be carded (certified) by a wildland agency prior to use in the WUI environment. Private vendors may also provide aircraft on a call-when-needed (CWN) basis. These aircraft and flight crews must also have the proper certifications and a CWN contract with a government agency. Federal wildland agencies contract with private vendors under exclusive use contracts during fire season and these aircraft and crews are available for immediate dispatch. Agreements are in place for Federal military and California National Guard aircraft when specific criteria are met.

When planning air operations, firefighters should consider flight time restrictions and rest requirements for helicopter pilots. Per CAL FIRE policy, a single pilot can fly for seven hours in each 24-hour period. Other agencies have an eight-hour maximum flight time. The most restrictive policy takes precedence. CAL FIRE policy also states that pilots must have 10 hours of uninterrupted rest from the end of one duty day to the beginning of the next. Firefighters need to consider these restrictions when planning resources needs for the next operational period. Discuss air resource needs for the next operational period with the ATGS prior to the end of each day.

Type 1 Helicopters

Figure 6.15. Type 1 helicopters are capable of delivering large amounts of water, foam, or retardant in support of ground resources.

Type 1 helicopters can deliver a minimum of 700 gallons of water, foam, or retardant in a single drop. This makes them an excellent resource for suppressing and cooling large sections of fire line. Some Type 1 helicopters utilize a bucket to deliver their drops. Helicopters with buckets cannot split their drops. They empty the entire bucket in one drop.

Type 1 helicopters with fixed tanks are called helitankers. These aircraft may also carry foam or retardant and are capable of splitting their load into multiple drops. To refill the tanks with water, helitankers hover over bodies of water and use a snorkel device or they may need to be filled on the ground by a fire engine.

Type 1 helicopters are most cost-effective if the water source is reasonably close to the incident. As a general guideline, a Type 1 helicopter should be able to reload and return to the scene within 10 minutes to be cost effective.

A Type 1 helicopter may be compared to a master stream appliance on a large structure fire. When large volumes of water are required, a Type 1 helicopter is well suited for the task.

Some Type 1 helicopters are carded for personnel transport missions. They can carry between 16 and 35 personnel to the fireline. They require a large helispot for landing. They may also carry large payloads of supplies and equipment. Most large military helicopters are approved for transportation of fire personnel.

Type 2 Helicopters

Figure 6.17. The versatile Type 2 helicopter not only performs direct suppression tactics such as water drops, but also performs support missions such as crew shuttles and cargo deliveries.

Type 2 helicopters are the most versatile air asset on an incident. Type 2 helicopters can perform multiple missions including recon and mapping missions, firefighter and cargo transport, medivac and rescue missions, aircraft coordination, aerial ignitions, and hotspotting using water, foam, or retardant drops.

Type 2 helicopters can be configured with a bucket or a fixed tank. Some tanks can be refilled using a snorkel while others are refilled by engines. This task should be reserved for Type 1 or 2 engines with their larger tank and pump capacity. Type 2 helicopters can carry a minimum 300 gallons of water, foam, or retardant. In the WUI environment, when visibility allows, the accuracy of helicopter drops makes them an excellent resource for suppressing fire and close air support of ground personnel.

Many agency Type 2 helicopters can rescue civilians and firefighters utilizing a rescue hoist or short haul configuration. Consider this option for life threatening situations in the WUI environment.

Some Type 2 helicopters are restricted to drops and cargo delivery, and cannot carry passengers. Firefighters need to clearly articulate mission needs when ordering Type 2 helicopters.

Figure 6.18. Helicopters are crucial for fireline medivac and rescue missions..

Type 3 Helicopters

Type 3 helicopters are best-suited for reconnaissance or to provide aircraft coordination as a Helicopter Coordinator (HELCO) or ATGS platform. These helicopters are often equipped with specialized mapping capabilities, forward-looking infrared (FLIR) cameras, and video cameras.

Type 3 helicopters have limited water dropping and crew transport capability but can deliver supplies. Firefighters need to clearly articulate mission needs when ordering Type 3 helicopters.

Figure 6.19. Type 3 helicopters are well suited for reconnaissance missions and as HELCO platforms.

Helitack Crews

Helitack crews are inserted by helicopter into sections of the incident to aggressively attack the fire with hand tools while the helicopter supports them with aerial drops. Many wildland agencies have dedicated helitack crews available for response to both initial attack and large fire incidents.

The size of a helitack crew depends on the type of helicopter to which it is assigned:

- Type 1 = a minimum 10 people
- Type 2 = 5 – 9 people
- Type 3 = 3 – 5 people


Figure 6.20. Agency helitack crews are also trained to establish maintain and coordinate helibases for crew shuttle , cargo delivery, and reconnaissance missions.

Once inserted, the helitack crew establishes an anchor point and constructs scratch or holding line while the helicopter cools hot spots ahead of the crew. The crew may also take advantage of roads or natural fuel breaks for perimeter control lines and conduct firing operations. The crew may also assist engine companies with hose lays and structure defense operations.

Figure 6.21. Night helicopter operations must demonstrate a need for this type of action and comply with individual department policies.

Some helitack crews have specialized capabilities to conduct rappel operations and rescue missions. They can also assist with medivac missions for injured civilians and firefighters.

Agency helitack crews are trained to manage helibases and helispots. This includes providing a safe environment to support and oversee:

- Loading and off-loading personnel, cargo, and supplies
- Fueling operations
- Helibase crash/fire protection
- Air traffic around the helibase and incident area
- Air frequencies
- Flight time, costs, and other administrative requirements

The most effective and efficient use of a helitack crew is to work it in unison with its helicopter. Separating a helitack crew from its helicopter makes both resources less effective. One exception would be pairing a helitack crew with air tankers after the helicopter inserts the crew on the scene.

Exercise caution when deploying helitack crews in high wind fires. If high winds ground aircraft after the crew is inserted, it may become stranded in a remote location. During high wind situations a helitack crew may be most effective establishing and coordinating the incident helibase.

Night Flying

Some agency helicopters are authorized, trained, and equipped to fly after dark. Night flight operations are dangerous and should only be considered when firefighter or civilian lives, structures, or critical infrastructure are threatened. ICs must evaluate the risk versus gain and determine if a night operation will have a direct influence in incident mitigation or personnel safety. The CAL FIRE Helicopter Night Flying policy (Handbook 8363.3.4.2) and the FIRESCOPE Night Flying Guidelines outline the appropriate time and place to engage fires at night with helicopters.

Figure 6.22. Firefighters should be familiar with the capabilities of the various types of air tankers to ensure maximum effectiveness.

Air Tankers

Air tankers are a valuable resource for constructing direct, indirect, and parallel line in support of ground resources. Direct line is constructed along the fire edge in the unburned vegetation to reduce fire intensity and slow fire spread.

However, missed drops may drift into the burn and be ineffective. Indirect line is constructed some distance ahead of the fire in anticipation of the fire reaching that point. Parallel line is constructed a short distance from the fire edge taking advantage of barriers and lighter fuels. This is the most common type of air tanker drop. Retardant, by design, is going to reduce the amount of energy released by the fire when the fire comes in contact with the retardant.

Air tankers are categorized by their size and payload.

ICS MINIMUM STANDARDS – AIR TANKERS				
	TYPES			
	1	2	3	4
Gallons (min.)	3000	1800	800	200
Examples	C-130, BAE146	Legacy BAE 146, P2V	S-2T	Air Tractor 802

Air tanker drop configurations include dropping the entire payload at one time or a split drop (dropping portions of the payload at different times).

Ground personnel, the ATGS, or HELCO should use target descriptions to describe drop locations to the air tanker. Utilize parts of the fire and terrain features rather than cardinal direction. Indicate where the drop should start and end and the desired *coverage level*. Coverage levels range from 1 to 9. Lighter fuels (grass or light brush) require a lower coverage level than heavy brush or timber. When communicating the target description include information on surface wind speed and direction, and any potential flight hazards (tall trees, antennae, wires, power lines, or other aircraft in the area).

Coverage Level
The amount of retardant dropped in a 10' x 10' (100 square foot) area.

Figure 6.23. The BAE 146 Type 1 airtanker carries a minimum payload of 3,000 gallons. The legacy BAE 146 is a Type 2 airtanker which carries a minimum payload of 1,800 gallons.

Avoid using air tanker drops mid slope. The fire may burn through or around the retardant line and continue to the top of the ridge. Drop the retardant at the top of the ridge and work the flanks of the fire downhill. Mid slope drops can be used to defend a structure but are unlikely to slow or stop fire spread.

Figure 6.24. The C-130Q is one of the new generation air tankers. It is a Type 1 airtanker carrying a payload of 3,000 gallons of retardant with a constant flow tank.

Air tankers can drop retardant to create check lines for structure defense. This may slow the fire spread and intensity and extend the available time for ground resources to prepare the structure for defense. A "V" pattern drop around a structure creates an effective check line.

Visibility impacts drop capabilities around structures. Drops should be made well in advance of the fire front and smoke column. Visibility also reduces the pilot's ability to navigate around hazards.

Air tankers are in limited supply and are always assigned to the highest priority fire. They must be re-ordered every day for the following operational period.

Type 1, 2, 3, and 4 Air Tankers

The difference between air tankers is their size and payload capabilities. All four are valuable in the WUI environment. Smaller air tankers (Type 3 and 4) are more maneuverable in steep topography and where numerous flight hazards are present. Type 1 and 2 air tankers have faster response times over long distances. All four tankers utilize the same tactics, but Type 1 and 2 tankers carry more retardant and are more effective at building indirect line.

VLAT – Very Large Air Tanker

VLATs hold more retardant and create a substantially larger drop pattern than conventional air tankers. VLATs have a retardant capacity of 10,000 gallons or more and are capable of multiple retardant drops. VLATs may construct anywhere from ¼ to ¾ of a mile of retardant line making them an effective resource with large fire fronts. VLAT retardant line is substantially wider than that of other air tankers, allowing the retardant to slow the advance of large fire fronts. Due to their large payload, VLATs can free up other air tanker resources for re-deployment. Consult with the ATGS to discuss tactical and logistical considerations before requesting a VLAT.

Figure 6.25. The turbine S-2 is the mainstay of the CAL FIRE air tanker fleet. The S2T (Type 3) carries 1,200 gallons of retardant with a constant flow tank.

Figure 6.26. MAFFS (Modular Airborn Fire Fighting System) are National Guard assets that are deployed during periods of signifcant fire activity. They are a Type 1 airtanker carrying 3,000 gallons of retardant.

Figure 6.27. VLATS are capable of dropping very large amounts of retardant over a wide area.

Tactical Application

TACTICAL APPLICATION OF AIRCRAFT IN THE WUI	
Check and Go	No tactical application. Aircraft can provide information about structure threats to command and operations personnel. They can help ground resources determine access and helicopters could land and notify civilians in remote areas of the threat.
Prep and Go	Air drops around structures can create control or check lines that help reduce fire spread and intensity. This creates time for firefighters to positions themselves for tactical advantage.
Prep and Defend **Bump and Run**	Air drops around structures can create control or check lines that help reduce fire spread and intensity. This creates time for firefighters to positions themselves for tactical advantage. They may directly support firefighters during fire front impact with continued air drops on or around structures. Consider visibility and the safety of all ground personnel before dropping.
Fire Front Following	Poor visibility may prohibit the use of most aircraft for close support. As smoke clears, aircraft may be useful supporting ground resources engaged behind the fire front.
Anchor and Hold	Aircraft may be used to suppress embers, spot fires, and in some cases, structure fires (to limit ember cast). It is imperative to coordinate aerial and ground operations to mitigate safety concerns and avoid using conflicting tactics.
Connect the Dots	Aircraft may be used for close support of ground resources to temporarily connect secured sections of perimeter lines.
Tactical Patrol	Aircraft can be used for reconnaissance and should be available to support ground resources in the event of a significant flare up or escaped fire situation.

Firefighting Chemical Application

Fuel is the one element of the fire triangle significantly affected by the prudent and knowledgeable application of fire chemicals. The effects of fire chemical application are most profound on the rate of fire spread and fire intensity.

Figure 6.28. Pretreating the "green" side of a prepared control line with retardant in advance of a firing operation is a vital role of the incident's fixed wing air resources..

Rate of spread estimates from fixed and rotary wing aircraft are usually more accurate than estimates from ground resources. Fire intensity observations based on flame lengths, should be estimated by ground resources. Use these estimates to calculate the length and width of retardant line to be constructed and the amount of retardant, gel, or foam to be delivered.

The use of fire chemicals for perimeter control, structure defense and defense of infrastructure greatly increases the probability of incident success. Any suppression action using water should include the use of foam or gel to maximize the water's effectiveness.

Fire Chemical Categories

There are three categories of fire chemicals:
- Retardants
- Foams
- Gels (water enhancers)

Retardants

Long-term retardants contain salts that alter the way the fire burns decreasing the fire's intensity and slowing the fire's rate of spread. This effect continues even after the water in the retardant evaporates. The water in retardants is a mixing agent and serves primarily to aid in the uniform dispersal of the retardant over the target area. Because retardant still works after it has dried, it may be applied many days ahead of anticipated fire front impact.

Figure 6.29. Long term retardants can be effectively applied from ground based platforms allowing for greater flexibility when choosing application sites.

Depending on current fire behavior intensity, retardant may remove enough heat from the fire front to allow engines, crews, or dozers to aggressively engage the fire using direct attack tactics to stop its advance. It is incumbent on all fire suppression personnel to remember that retardant drops must be followed up by an aggressive ground attack. It should not be assumed that a retardant line will stop the fire, it simply retards its spread.

Retardant may be applied directly to the fire's edge where its extinguishing capability will be as effective as water. It may also be applied indirectly, away from the fire's edge, allowing the fire to burn into the retardant line.

Retardant can also be effective in supporting firing operations. By constructing retardant line on the opposite side of the control line from which firing will take place, the intensity of spot fires may be significantly reduced allowing holding forces to aggressively engage and control a developing spot fire. The retardant can be applied days in advance of a planned firing operation. It may also be applied around structures in the WUI, ahead of the fire front, and will remain effective until washed away.

Tactical Application of Retardant

Ground Application

Long-term retardants are only effective on natural fiber material such as trees, brush and grass. Retardant is also effective on wood fiber products such as unpainted lumber and shake or shingle roofing. Retardant should only be used on unburned vegetation, in either a direct or indirect application, at or near the fire front or in preparation of a planned firing operation, Retardant should not be used for mop-up.

Tactical water tenders and fire engines may be retardant capable, depending upon the apparatus' configuration, and are useful for direct suppression action or pre treating vegetation in the WUI. Pre-treating vegetation is most effective using water tenders with deck guns and spray nozzles capable of maintaining a 200 foot variable stream.

Aerial Application

Retardant is typically applied on ridge tops, rather than mid-slope to take advantage of favorable topography and fire behavior conditions. Usually, retardant is applied along the flanks of the fire starting at an anchor point moving toward the head. Direct application of retardant at the head of the fire is difficult due to heavy smoke and may, in fact, split the head creating more problems for the IC.

Considerations for aerial retardant application:
Consider the vector or flight path of the aircraft in reference to the direction of spread, and where the retardant is placed in relation to the fire front allowing the advancing fire front to impact the retardant line at about the same time the aircraft returns from reloading.

- Effective retardant coverage or requirements may vary for the same fuel type, depending on fire line intensity. Too heavy of an application will waste retardant and reduce the amount of line that can be constructed over a given period of time, while too light an application will diminish the retarding capability of the chemical

- Given the most extreme fire intensities, doubling the retardant coverage levels may still not be adequate to slow the spread of the fire.

- Timing of chemical applications must coincide with the specific tactic for maximum effectiveness. Do not apply retardant on an active fire front if ground resources are not available to support the retardant line, unless the application is for a temporary holding action or check line.

NWCG Guidelines: The National Wildfire Coordinating Group developed the following guidelines for retardant use:
- Determine direct or indirect tactics based on size-up and resource availability.
- Establish an anchor point and advance the retardant line from that point.
- Offer honest accuracy and coverage evaluations maintaining effective communication between ground and air resources.
- Monitor retardant effectiveness and adjust its use accordingly.
- Use direct attack only when ground resources are immediately available to aggressively support retardant drops, or if controlling a particular section of the perimeter fire can be successful without ground resource support.

On large incidents the Air Operations Branch Director (AOBD) may select strategic sites within the operational area to establish portable retardant or gel plants. The availability of a plentiful water supply is a major factor for site selection. A portable retardant plant may reduce helicopter turnaround times dramatically, enhancing air support for ground resources.

Retardant Safety Concerns

Wet retardant has the consistency of raw eggs, it's very slippery and creates safety hazards for resources on the ground. Safe footing may be compromised on steep slopes covered with retardant. Tools covered with retardant can easily slip out of the hands of the user becoming dangerous projectiles. Retardant on asphalt roadways compromises traction and is a particular concern for traffic and should be washed off as soon as possible.

Close air support in the WUI environment may result in the accidental application of retardants or water enhancers onto structures or vehicles. Remove the chemicals as soon as operationally feasible in order to prevent damage to private property and reduce slipping hazards for homeowners and incident personnel. Line supervisors should be advised of any hazardous condition resulting from the use of retardant.

All aircraft operations, including retardant application, increase the risks for both air and ground resources. The priority for all aircraft operations is safety and adherence to department and FAA policy.

Low-level retardant applications occur infrequently but are quite hazardous. The minimum drop height for fixed-wing aircraft is 150 feet above the vegetation. Single engine air tankers, SEATs, may drop from 80 feet above the vegetation, SEAT drops can be as low as helicopter drops, but at a much higher rate of speed. Water scooping aircraft such as CL-215/415 have similar drop heights as single engine airtankers (SEATS).

Figure 6.30. The payload of an air tanker includes the weight of the retardant and the velocity of the aircraft. Retardant drops have been known to cause tremendous damage to vehicles and structures as well as injuries to personnel on the ground.

Ground resources should be warned when incoming air tankers and helicopters are on final approach to the target and take appropriate protective action. Ground resources should also notify air resources of any aerial hazards or damaged or weakened trees that may that may be in the drop zone.

Retardant drops from a Type 1 air tankers may contain 25,000 pounds of retardant traveling at a very high rate of speed. The impact of this mass may cause serious injury to personnel and significant damage to equipment or structures involved in a direct hit. If a low-level drop occurs, advise air attack or the ATGS, immediately to correct the action and document the event.

Foams

Class A wildland fire foams have no long-term retarding effect on forest fuels. Once the water it contains evaporates, foams cease to be effective. The suppressant qualities and penetrating ability of foam make it a superior product for direct attack tactics and mop-up operations. However, foam is the most toxic of all fire chemicals and must be used with caution around waterways. Foams may be applied by engines, aircraft, and backpack pumps.

Foam works in two ways:

- Foam breaks the surface tension of forest fuels allowing water to quickly penetrate the surface of the fuels, where it cools and extinguishes the fire. The most effective foams for this type of application are low-expansion foams.
- When the fuel is coated with a blanket of foam, the foam creates a barrier, insulating the fuel from radiant heat and excluding oxygen, disrupting the combustion process. These foams are usually called high-expansion foams and must be well aerated when applied. This foam is often delivered from compressed air foam systems (CAFS). High-expansion foams retain the water they contain, providing a longer lasting insulation effect.

Figure 6.31. Foam should be liberally applied with emphasis on the fire impact side of a threatened structure.

Gels

Water enhancers (also referred to as gels) have no long-term retarding effect. Gels depend on the water that they contain to suppress the fire. Once that water evaporates, they are no longer effective. Depending on its consistency, gel can be an excellent insulator and cooling agent for fire suppression.

Gels are made of polymers that absorb water. When mixed with water these polymers resemble sponges, soaking up the water then releasing it slowly, increasing the time it takes for the stored water to evaporate. Variables such as the size of the gel particle, the polymer formula, and the chemical nature of the water mixed with the gel affect gel's consistency.

Gels' ability to hold water in a compact layer makes it very effective for direct suppression action, short-term fuel pre-treatment for structure defense preparations, or in support of a firing operation. gels will not penetrate fuels like foam and water do. Do not use gels for mop-up operations unless the goal is to keep the area moist.

Gels:
- May be a wet concentrate or dry powder, and must be mixed accordingly
- Contain ingredients designed to alter the physical characteristics of water to increase its effectiveness, aerial application accuracy, and adhesion to fuels
- May be applied by engines, specially designed gel tenders, aircraft, and backpack pumps
- May be colored
- May be very slippery
- After drying out, gels can be re-activated by adding water
- Are rapidly degraded back to water when impacted by salt

Tactical Application of Foams and Gels

Application by ground resources: Pre-treating structures with foams and gels is time consuming and labor intensive for both application and clean up once the fire threat has been mitigated . Gels, and foams are typically applied at a thicker viscosity in order to adhere to vertical surfaces. Gels and foams should be applied with the expected time of the fire front impact in mind. When using gels and foam for structure defense pretreatment, consider the fire front impact at the structure so that gels and foams are not applied too soon. If gels and foams are applied too soon the water they contain may be completely evaporated by the time the fire front impacts the structure, rendering them useless. When gels and foams dry out they leave a residue of inactive ingredients on both vertical and horizontal surfaces that can be difficult to see. This residue is re-activated by applying water creating very slippery surfaces. Gels must be washed away from around structures and any other area where public traffic may be present, especially in areas where there is little sun exposure.

Tactical water tenders and fire engines may be gel or foam capable, depending upon the apparatus' configuration. Pre-treating vegetation is most effective using water tenders with deck guns and spray nozzles capable of maintaining a 200 foot variable stream. Most modern engines are equipped with foam proportioners. Never run gel through a foam proportioner without manufacturer approval.

Engines without gel mixing capabilities may use a low viscosity, pre-mixed gel for mobile attack or hose lay operations. Fire equipment equipped with gel or foam proportioners can apply thicker concentrations. Water tenders may be loaded with water enhancers for either direct application or transfer to engines. Tactical water tenders may either load, or be loaded with gels depending upon the apparatus' capabilities.

Aerial Application

Effective gel application with air tanker drops remains the topic of much needed research. Helicopter operations are currently the most effective way to apply gels from the air.

Environmental Issues

Policy for Delivery of Aerial-Applied Wildland Fire Chemicals

Policy for chemical application from the air is constantly changing. Agency personnel must be aware of their agencies policies, as well as the policies of any assisting and cooperating agencies .

CAL FIRE policy follows the United States Forest Service 2000 and 2008 *Guidelines for Aerial Delivery of Retardant or Foam near Waterways*, established and adopted by the United States Forest Service, CAL FIRE, the Bureau of Land Management, the National Park Service, and the United States Fish and Wildlife Service. This policy has been expanded to include all wildland fire chemicals, including water enhancers (gels).

The Qualified Products List (QPL), available on the USDA Forest Service website, lists the chemicals authorized for use by CAL FIRE, the United States Forest Service, and the Department of Interior, on lands under direct agency protection or ownership.

CAL FIRE policy:

Avoid aerial application of wildland fire chemicals within 300 feet of waterways. A waterway is defined as any body of water including lakes, rivers, streams and ponds, whether or not they contain aquatic life. This policy does not require the helicopter or air tanker pilot-in-command to fly in such a way as to endanger the aircraft, other aircraft, structures, or compromise ground personnel safety.

To meet the 300-foot buffer zone guideline:

- Pilots: Pilots shall make adjustments for airspeed and ambient conditions, such as wind, to avoid the application of wildland fire chemicals within the 300-foot buffer zone.
- Ground Based Equipment: When setting up chemical plants and applying chemicals near a water source, there must be a 300-foot buffer between any water way and the deployment site.

Figure 6.32. Care must be taken to locate portable retardant plant at least 300 feet from a known waterway.

Exceptions:

When alternative fire chemical line construction tactics are not available due to terrain constraints, congested areas, life and property concerns, or lack of ground suppression personnel, it is acceptable to anchor the wildland fire chemical line to a waterway. When anchoring a wildland fire chemical line to a waterway, use the most accurate method of delivery in order to minimize placement of wildland fire chemicals directly into the waterway. This may require using helicopters for more pinpoint accuracy or by using ground resources to apply the product if necessary.

Allowable deviations from current policy may vary from agency to agency, but are acceptable when life is threatened and the use of wildland fire chemicals can be reasonably expected to mitigate the threat. When potential damage to natural resources outweighs possible loss of aquatic life, the unit administrator may approve a deviation from these guidelines. If it is determined that there is a potential for adverse environmental effects (if retardant is dropped within 300 feet of a waterway), the IC should notify the agency resource adviser or ECC to make a notification to the US Fish and Wildlife Service or California Department of Fish and Wildlife for follow up as soon as possible, or by the end of the next burning period.

In 2012 the USFS changed its policy as a result of an environmental impact study completed in 2011 for USFS lands. The new policy includes the addition of exclusion zones, increased buffer zones, and exceptions to the policy, study, and reporting processes.

Related Terms:

- Aquatic Avoidance Areas:

All bodies of water with a 300-foot buffer; this includes perennial streams, intermittent streams, lakes, ponds, identified springs, reservoirs, and vernal pools

Buffer areas may be adjusted for local conditions and coordinated with the U. S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) fisheries offices

- Terrestrial Avoidance Areas:
  Terrestrial Avoidance Area Mapping may be used to avoid impacts to one or more federally listed threatened, endangered, or proposed (TEP) plant or animal species or critical habitat where aerial application of fire retardant May Affect (MA) habitat and/or populations

  Terrestrial Avoidance area mapping may be used to avoid impacts to any Forest Service terrestrial sensitive or candidate species where aerial application of fire retardant may result in a trend toward a federal listing under the Endangered Species Act or a loss of viability of the planning unit.

Per policy and inter agency agreements, all fires will be managed by the rules of engagement for the responsible agency whose lands are being protected.

Chemical Use Decision Process

Communication is the key to the fire chemical use decision process. Feedback between air attack, lead planes, air tankers, and ground personnel must be a continuous process.

FEEDBACK PROCESS	
Define Objectives	Defend structures or high value watershed? Hold the fire until ground forces arrive? Support a firing operation? Suppress the fire for perimeter control?
Formulate Strategies	Where to attack the fire (head, flanks, heel, etc.)? Are there sufficient ground forces to support the retardant line? Is there enough reflex time between aircraft drops to carry out the objectives? Will bodies of water be impacted? Is the proximity of available water suitable to support the plan?
Identify Tactics	How many drops will be needed? Are there enough air resources available? Will loads need to be split? Will the tactics be based on direct, indirect, or a combination attack? Will chemicals be delivered from tactical water tenders, helicopters, air tankers, or engines?
Assess Results	Are the tactics appropriate for the strategies? Are the strategies meeting the objectives? Were tactics successful in protecting water courses or water bodies?
Review Steps as Needed	Are the objectives still valid? Are the strategies still valid and the tactics effective? If not, reformulate the plan developing new objectives, strategies and tactics.

SUPPORT EQUIPMENT

Squads and Ambulances

The IC should have a plan to address potential firefighter and civilian injuries and order squads or ambulances early in the incident. These resources can respond to medical emergencies within the fire perimeter or anywhere on the fire ground, allowing EMS-equipped engines to remain engaged in structure defense or perimeter control. Consider assigning an advanced life support (ALS) unit to the most centrally located staging area.

Squads

Squads, typically smaller, self-contained, pickup truck based vehicles, may be used to scout the fire or engage in limited direct suppression activity. Squads may also be used to assist with evacuations and other non-suppression tasks. Squads may be grouped with other resources into a task force, adding depth and diversity to the force. Squads are often staffed with medically-trained personnel, making them useful in the event of medical incidents within the incident.

Ambulances

Ambulances staffed by fire service personnel provide emergency medical services and can assist with evacuations and provide intelligence to line supervisors. Exercise caution when sending private ambulances into an active fire area. Private ambulance services may or may not have an appropriate level of training and Personal Protective Equipment (PPE). Multiple ambulances may be needed when evacuating care facilities or hospitals. The IC may need to assign a Medical Group Supervisor when using multiple ambulances. ICs should consider forming a medical group to respond to medical emergencies on the incident. The medical group supervisor should have a medical background such as a paramedic or EMT and should also be an experienced wildland firefighter. The medical group supervisor should ensure that ambulance personnel are briefed on the incident status, are wearing appropriate PPE and know the exact nature of the medical emergency they are responding to.

Water Tenders

A water tender is a mobile water supply. Water tenders can provide water to engine companies assigned to remote fire areas that lack water supply systems (hydrants, tanks, etc.). Some can also

MINIMUM ICS STANDARDS – WATER TENDER

	Water Tender Type				
	Support			Tactical	
Requirements	S1	S2	S3	T1	T2
Tank capacity (gal)	4000	2500	1000	2000	1000
Pump minimum flow (gpm)	300	200	200	250	250
Pump @ rated pressure (psi)	50	50	50	150	150
Max. refill time (minutes)	30	20	15	-	-
Pump and roll	-	-	-	Yes	Yes
Personnel (min)	1	1	1	2	2

provide dust abatement, directly suppress fires, and provide potable water supplies.

Water tenders are classified by function (support or tactical) and size per NWCG and FIRESCOPE.

Figure 6.33. Tactical water tenders that meet ICS standards can take direct action in support of incident strategy and tactics.

Tactical Water Tender

- A water tender fully capable of wildland fire suppression operations
- Fully trained personnel as per NWCG standards
- Must have pump and roll capability
- Must have a foam proportioner
- May also be used for support functions (watering roads)

Support Water Tender

- Used in supporting firefighting operations
- Water transportation to tactical equipment
- Personnel have minimum fire safety training
- Used for watering roads and supporting camp operations

**CAL FIRE has opted to maintain its current practice and will not be adopting the 5 national water tender types. CAL FIRE will continue to utilize existing fireline water tender typing standards. Currently, CAL FIRE classifies all water tenders used in fire suppression activities as "Fireline Water Tenders". Fireline Water Tenders are further categorized as Type 1 or Type 2 based on tank capacity and pumping capability. A Type 1 Fireline Water Tender must be capable of carrying a minimum of 2000 gallons of water and must be equipped with a 300 gallon per minute pump or greater. A Type 2 Water Tender must be capable of carrying a minimum of 1000 gallons of water and must be equipped with a 120 gallon per minute pump or greater.*

Per CAL FIRE Coordination and Supervision policy 7761.1.1, privately owned water tenders under agreement with CAL FIRE shall not be engaged in direct fire suppression efforts on any active fire line.

Private (Hired) Equipment

On WUI incidents there will be a need to order and assign private equipment of all types. As an incident escalates in complexity and the number of pieces of hired equipment exceeds the span of control, order a technical specialist for hired equipment.

Agency personnel should coordinate with and supervise private mobile suppression equipment such as water tenders, gel or foam apparatus, dozers, and aircraft at all times. Private mobile suppression equipment can work alongside agency equipment or be assigned as a part of a task force, strike team, or group under agency supervision.

CAL FIRE recognizes that it is impractical for hired equipment contractors to provide comprehensive

**This policy differs from FIRESCOPE as of April 2014.*

wildland firefighting training to their employees. Under CAL FIRE Policy, Hiring and Utilization Guideline 7761, the department has adopted policies that define its commitment to provide adequate supervision and accountability of hired equipment.

If private equipment arrives at the scene without an order and request number, the equipment may be hired and given an assignment after conducting a proper review of the equipment's condition, safety features, and the operator's qualifications. If the operator does not have an emergency equipment rental agreement, complete one prior to assignment.

When using hired equipment on an incident, ICs and line supervisors must brief the contractor or operator on the incident situation, strategy and tactics, safety concerns, and command expectations while assigned to the incident. Use the IRPG briefing checklist. Hired equipment operators may only have basic safety training and limited experience and should be assigned with those limitations in mind.

FEMA Coordinated Resources

FEMA (Federal Emergency Management Agency) coordinated resources have become more common in the WUI environment, especially during widespread conflagrations. These resources are made up of agency and contract personnel from across the United States to assist with WUI fires designated as national disasters.

FEMA resources may:
- Have limited training and experience
- Not be familiar with WUI operations
- Require supervision to ensure that they are assigned and utilized consistent with their capabilities
- Need basic wildland firefighting tools to accomplish their assigned task
- Have contractual or policy direction that precludes them from engaging in structure defense or structure firefighting

Private Industry Fire Response

Some insurance companies hire private resources to provide loss prevention services, in the form of fire response, to homeowners under their policy coverage. This generates many questions concerning command and control, safety, and accountability on the fire ground.

Line supervisors should anticipate that private resources may be present if there is a threat to the homeowner subscriber's property. Use the FIRESCOPE Private Resource Utilization Guidelines and the CAL FIRE policy when working with private industry resources. See appendix pages A-9 through A-12 for the FIRESCOPE Guidelines and the CAL FIRE Policy.

Private industry resources hired to protect private property are not authorized to enter a closed area. If private fire response resources are issued an evacuation order, they must comply with the order. If they refuse, contact the appropriate law enforcement authority.

The insurance industry has been encouraged to have these resources contact the ICP to maintain accountability. They are not incident resources and should not be assigned any role in the incident.

Chapter

7

COOPERATING AGENCIES

Suppressing WUI incidents requires significant resources and support from numerous diverse agencies working together to protect values at risk, control the fire, provide for public safety, restore services, protect the environment, and return normalcy to the affected area.

PRE-INCIDENT TEAM BUILDING

Successful fire agencies build relationships and work directly with *assisting agencies* that directly contribute suppression, rescue, support, or service resources to an incident, and *cooperating agencies* such as law enforcement and utilities that supply other vital services during an incident.

Pre-incident team building, joint training, and networking are critical elements for interagency cooperation on a WUI incident. Pre-established relationships encourage a greater level of trust and understanding of common goals and expectations. Familiarity can instill a sense of calm during a chaotic situation, streamline the expansion of the incident organization, roles, and responsibilities, and reduce doubt and confusion.

> Assisting Agencies
> Agencies that directly contribute suppression, rescue, support, or service resources to an incident.

All cooperators should be on a first-name basis. Chief officers and company officers should build strong communication networks with assisting and cooperating agencies. Fire chiefs' association meetings, joint tabletop exercises, drills, and pre-incident planning efforts are just a few of the opportunities available to begin the interagency team building process. Informal meetings such as lunch or coffee can also go a long way toward developing and maintaining strong jurisdictional and personal relationships.

> Cooperating Agencies
> Agencies that provide non-suppression assistance services (i.e., law enforcement or utility agencies) during an incident.

Consider the following objectives when meeting with assisting and cooperating agency leaders:

- Make all agencies' expectations known before an incident. Clearly stated goals and expectations minimize the potential for confusion, surprise, and frustration during an incident.
- All cooperators should know each agency's capabilities and limitations in advance of an incident to foster a more effective use of resources.

Figure 7.1. Successful incident mitigation depends on firm working relationships between all agencies.

- Agencies should train together before an incident occurs. Encourage regular interagency training exercises utilizing realistic scenarios. Interagency training is a prerequisite for successful command of multiagency incidents.
- Discuss how information will be communicated to the media, government officials, and the public.
- The IC will only assign one incident PIO, but he or she may have assistant PIOs that represent specific assisting or coordinating agencies. All public communications need to be coordinated through the incident PIO.
- Consider organizing an *after action review* (AAR) of recent multi-agency incidents. After action reviews give each agency representative (AREP) a chance to share philosophies and experiences as well as develop an understanding of each agency's strengths and weaknesses.

> After Action Review
> A structured review process for agency administrators and firefighters to analyze what happened, why it happened, and how it can be done better.

COOPERATING AGENCIES

Cooperating agencies are generally non-fire agencies assuming a support role in the suppression effort such as law enforcement, public works, highway departments, and EMS authorities and other non government organizations such as the Red Cross, Salvation Army and volunteer groups for animal rescue. ICs should consider using local government emergency services or emergency management agencies to aid in the effort.

Figure 7.2 Low stress encounters with assisting agency personnel such as inter agency training or WUI planning operations foster a cooperative working attitude.

Law Enforcement

Law enforcement is one of the most important cooperating agencies involved in any WUI incident. Law enforcement is critical for successful evacuations, traffic control, and security. The IC should embed law enforcement personnel into the incident organization so that they are not sitting on the sidelines waiting for direction or taking independent action.

Figure 7.3. Law enforcement is a welcome partner during the chaos of a rapidly expanding WUI incident.

ICs can take some relatively simple steps to successfully integrate law enforcement into the incident organization:

- Establish positive pre-incident working relationships. Meet and discuss potential evacuation plans, communicate law enforcement expectations at the incident command level, and include law enforcement in joint training exercises.

- Request law enforcement as part of the initial resource order to assist with evacuations, traffic control, and security. Request a law enforcement representative with the authority to make direct command and control decisions regarding the incident and law enforcement resource utilization. Every law enforcement agency is different, but a sergeant or higher ranking officer is usually suitable for this role. Law enforcement representatives should report to the ICP and work closely with the IC or OSC. If multiple law enforcement agencies are involved in the incident, it is beneficial to have only one law enforcement AREP work directly with the IC or OSC to streamline the decision-making and communication process.

Figure 7.4. Order law enforcement early in the incident for traffic control, road closures, and civilian evacuations.

- Physically locate law enforcement at the ICP to provide real-time communications and coordination between law enforcement field units and the IC or OSC. Consider creating a law enforcement branch, group, or task force to manage large numbers of law enforcement personnel. Embed law enforcement representatives with operations section personnel for real-time incident and evacuation intelligence gathering and communication to enhance evacuation coordination, traffic control efforts, and situational awareness. Under certain circumstances, it may be appropriate to integrate law enforcement into unified command. This will ensure their agency jurisdictional needs are included in the incident objectives, and enable joint planning and execution of both fire and law enforcement strategic objectives. Include law enforcement in all planning meetings and operational briefings to keep them fully engaged in the incident organization.

As with any form of interagency cooperation, working with law enforcement will lead to challenges and minor disagreements. Try to resolve concerns through prior planning and scenario-driven training. It is critical to take the appropriate diplomatic steps to secure cooperation and participation prior to an incident. If problems or disagreements persist, higher levels of management may need to be consulted.

Animal Control

Animal control's primary role is to coordinate the evacuation and sheltering of livestock and exotic animals. Smaller household pets are typically evacuated by their owners but animal control may need to rescue animals left behind or provide shelter for household pets not permitted in human evacuation shelters.

It takes time for animal control to mobilize the volunteers, vehicles, and trailers needed for incident response. Therefore, animal control should be notified and included early in any WUI incident. Animal control is often overlooked until the need becomes obvious. At that point, it may be too late to effectively manage the problem. Local protocol usually dictates whether the IC or law enforcement AREP should order animal control.

Animal control needs significant reflex time to accomplish its mission. Consider issuing an evacuation order for large animals simultaneously when issuing an evacuation warning for the human population. This timing scenario ensures that large animals and the vehicles required to move them have an opportunity to clear the evacuation area before people are ordered to evacuate and incident resources need to enter the area. Animal control should coordinate closely with law enforcement to avoid traffic congestion along evacuation routes.

Animal control agencies may not know how to interact and coordinate their services within the incident command system. Frequent training and planning with animal control will increase success when an actual incident occurs.

Utility Companies

Utility company AREPs are a valuable resource, providing assistance and expertise concerning the incident's effects on their services and infrastructure, and how they may impact the incident. Order utility company AREPs early and have them report directly to the ICP.

Utility company AREPs commonly involved in WUI incidents include:

- Water companies
- Electric companies
- Gas/propane companies
- Waste water treatment facilities
- Public works or road departments

Figure 7.5. Animal control is an essential cooperating agency often coordinating the evacuation and care of pets and large animals.

Figure 7.6. To avoid confusion and chaos during a complex and rapidly expanding incident, include animal control and large animal rescue.

Figure 7.7. Utility companies can mobilize equipment and personnel similar to fire resource mobilization and are an essential cooperating agency for firefighter safety and the restoration of services.

- Transportation agencies
- Railroad companies
- Pipeline companies
- Phone and cellular communication providers
- Cable television companies
- Internet service providers

Figure 7.8. Utility companies begin repairing infrastructure and restoring service as soon as it is safe to enter the fire area.

It is helpful to have an electrical utility AREP on scene to deactivate power to downed electrical transmission lines, and confirm that the power has, in fact, been cut to ensure firefighter and public safety.

Consider the potential impact before shutting down utilities. Will de-energizing power lines shut down the pumps supplying water to the fire suppression effort? What are the adverse effects on facilities such as hospitals? Some negative effects cannot be avoided, but should be considered when contemplating curtailing any utility service.

It is unsafe to allow civilians to return to evacuated areas without first addressing public safety. Hazards such as downed utility poles, gas leaks, and unstable fire-related damage must be addressed prior to repopulating evacuated areas. Public works, road departments, and utility companies all play a role in assessing and mitigating those hazards.

The OSC should allow utility companies to re-enter affected areas as soon as they can safely work in the area. The operations section and Safety Officer should coordinate with law enforcement to ensure that utility vehicles have appropriate access to the incident.

Prior to signing a re-population plan, utility AREPs should ensure their utility is safe, especially before they energize or pressurize their service.

ASSISTING FIRE AGENCIES

Assisting agencies are generally local, state, and federal fire agencies directly involved in suppression efforts by providing engines, crews, dozers, aircraft, and personnel.

California has the ability to mobilize fire suppression resources through a variety of statewide and local fire assistance agreements. Utilizing assisting fire agencies requires the IC and the command and general staff to be familiar with these agreements and the authority for fire agencies to provide assistance.

Local Agreements

Fire agencies often enter into agreements with neighboring agencies to create a seamless response for services regardless of jurisdictional boundaries. These local agreements may be classified as automatic aid, mutual aid, mutual threat zone, and assistance-by-hire contract for services. Some of these agreements involve payment while others are an agreement to exchange services without compensation.

Automatic Aid

Automatic aid is an agreement established prior to an incident to provide service to another agency without first having to request permission. The resources of one agency are automatically dispatched to respond to an incident in a neighboring jurisdiction. This is usually done under the closest resource concept. Automatic aid agreements help adjoining agencies avoid duplicating services such as placing fire stations across the street from each other on opposite sides of a jurisdictional boundary. Automatic aid agreements may be assistance-by-hire, where money is exchanged, or mutual aid where no money is exchanged.

> Automatic Aid
> An agreement to provide services to another agency without first having to request permission.

Mutual Aid

Mutual aid is an agreement where one agency must request response assistance from another agency. The requesting agency makes the request and the requested agency bases its response on its current operational status. Usually, there is no money exchanged. Mutual aid is provided with the understanding that the agency receiving assistance will return the favor in the future.

> Mutual Aid
> An agreement where one agency must request response assistance from another agency.

Mutual Threat Zone (MTZ)

A *mutual threat zone* is an agreement where adjoining agencies agree and acknowledge that each may have an incident within a pre-designated zone in their jurisdiction that poses a threat to the adjoining jurisdiction. The agencies agree that when this occurs, the jurisdiction being threatened has the right to mount a coordinated resource response and enter into unified command in an effort to mitigate the threat. Under an MTZ agreement, each agency is usually responsible for paying its own costs.

> Mutual Threat Zone
> An agreement where adjoining agencies agree and acknowledge that each may have an incident within a pre-designated zone in their jurisdiction that poses a threat to the adjoining jurisdiction and when this incident occurs, the jurisdiction being threatened has the right to mount a coordinated resource response and enter into unified command in an effort to mitigate the threat to their jurisdiction.

The Los Angeles County Fire Department and the Ventura County Fire Department have an MTZ agreement. Whenever there is an incident within one mile of the county boundary, the threatened agency may dispatch resources to the incident and enter into unified command in a coordinated effort to mitigate the incident before it enters the other jurisdiction.

Assistance-by-hire Contract for Services

In an *assistance-by-hire* agreement, one agency agrees to pay another

> Assistance-By-Hire
> An agreement in which one agency agrees to pay another agency's pre-established rates for the services and resources that agency provides.

agency's pre-established rates for the services and resources that agency provides.

Statewide Agreements

There are three statewide fire assistance agreements in California:

- California Master Mutual Aid Agreement
- California Fire Assistance Agreement (CFAA)
- California Fire Management Agreement (CFMA)

California Master Mutual Aid Agreement

Under this agreement, signatory local agencies agree to send resources to assist requesting local agencies throughout the state of California. Master Mutual Aid is always free to the requesting agency; however, the requesting agency is obligated to provide logistical support such as fuel, supplies, and meals to the assisting resources.

CFAA

This agreement is between the federal and state wildland agencies and local government. Under this agreement, signatory local agencies agree to send resources to assist requesting federal and state wildland agencies on an assistance-by-hire basis. There may be a "no cost" period designated within the agreement. The assistance-by-hire personnel and equipment rates are pre-established within the agreement.

Figure 7.9. Local government agencies provide engines and personnel under the CFAA.

California Governor's Office of Emergency Services (OES) role under CFAA is to process the assistance requests, track the assisting resources, and facilitate payment to the assisting local government agency. OES's responsibility is to mobilize resources on a statewide basis when necessary.

CFMA

This agreement between the major forest agencies such as U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, U.S. Bureau of Indian Affairs and CAL FIRE describes how these agencies will work together and exchange resources.

Figure 7.10. USFS engines, crews and dozers are among the federal resources available through the CFMA.

There is usually a "no cost" mutual aid period designated within the agreement. If resources are required beyond that period they are paid from the time of dispatch using the pre-established assistance-by-hire rates for personnel and equipment within the agreement.

NOTIFICATION

Timely notification of all agencies affected by a WUI incident is crucial to successful interagency cooperation. As soon as the IC recognizes that the incident will impact another jurisdiction or require assistance from another agency, the IC should request that an AREP from that agency or jurisdiction report the ICP.

Figure 7.11. ICs should coordinate with the ECC to ensure that notifications to assisting agencies are made in a timely manner.

The IC should consider using a pre-established agency notification list for a WUI incident in a given operating area. Compiling this list from memory under pressure could result in failure to notify an assisting or cooperating agency with a stake in the incident. Failure to notify assisting and cooperating agencies may have a negative effect on interagency cooperation and jeopardize incident success.

A notification list may include:
- Law enforcement
- Highway patrol
- Assisting fire agencies
- Animal control
- Emergency medical services
- Utility companies
- Civilian support agencies (Red Cross, Salvation Army, etc.)
- Local OES representative
- Timber industry representatives
- Special districts, agencies and even businesses that may be affected by the incident, and whose cooperation will be beneficial to a positive outcome

Some agencies have pre-established notification lists incorporated into their dispatch protocol, taking a burden off of the IC at a time of intense incident activity when resource ordering details are easily overlooked. For example:
- A first alarm may include notifying law enforcement
- A second alarm may include notifying animal control, the Red Cross, Fish and Wildlife, and utility companies

The dispatch center needs to notify and confirm with the IC when the notifications have been completed, and provide the IC with the estimated arrival times of the various AREPs. Adding a LOFR to the incident organization will relieve the IC of the need to deal with individual AREPs.

Until a LOFR is assigned, the IC must carry out this function.

The Emergency Command Center (ECC) should always provide the assisting and cooperating agencies with the following information:

- Incident type and location
- ICP or reporting location
- Reporting time
- Reason for their involvement in the incident

Sometimes this information is obvious; other times it is not, and must be clearly communicated. It is always better to provide too much information than not enough.

EMERGENCY OPERATIONS CENTER/JOINT OPERATIONS CENTER

An *Emergency Operations Center* (EOC) is the physical location where the coordination of information and resources to support local incident management activities normally occurs. An EOC is a centralized location for decision making related to the jurisdiction's emergency response. At the EOC, individuals support emergency response actions, allocate local government non fire resources, and track and coordinate resources for the incident, On a WUI incident, the EOC's role is to provide incident support as needed.

Emergency Operations Center
The physical location where the coordination of information and resources to support local incident management activities normally occurs.

EOCs may be organized by major functional disciplines (fire, law enforcement, medical services, etc.) or by jurisdiction (federal, state, regional, county, city, tribal, or some combination thereof).

Effective EOC and incident command integration depends on pre-planned communications protocols. This may be facilitated by an incident representative making regular visits to the EOC to attend scheduled meetings and participate in conference calls. If the incident is dynamic and expanding, it may be necessary to assign an incident representative to the EOC. This could be a LOFR, a PIO, or a representative from the local fire agency with direct communications with incident command personnel. If assigned to an EOC, be prepared to assist EOC personnel with understanding resource ordering and the incident command system.

AFTER ACTION REVIEWS

Consider scheduling an After Action Review (AAR) with assisting and cooperating agencies after all major incidents, unusually complex incidents, or incidents involving injury, near miss, or death.

Use an AAR to analyze what happened and why it happened, and identify improvements to incident management activities, including interaction with assisting and cooperating agencies.

An AAR can be as simple as a conversation over a cup of coffee between engine companies or as formal as a meeting between representatives from the assisting and cooperating agencies. Tailor each AAR to fit the complexity and needs of the incident.

CHAPTER 8

EVACUATIONS

Evacuations are an integral part of many WUI incidents. Evacuations are complex undertakings requiring detailed planning and organization, a significant resource commitment, and the cooperation of numerous agencies and disciplines. A well conceived incident evacuation plan promotes cooperation by the agency tasked with implementing the plan and generally earns praise from the affected population. A poorly planned evacuation may compromise public safety and will undergo post-incident political and media scrutiny and public discontent.

ROLES AND RESPONSIBILITIES

Evacuations displace citizens and animals from familiar, comfortable surroundings and thrust them into an unfamiliar, uncomfortable, and chaotic environment. Evacuations predictably cause concern and confusion for the evacuees who cannot get real-time intelligence about their homes and pets and usually fear the worst.

Figure 8.1. Whether immediate need or planned need, prior planning and cooperation with law enforcement are essential for a safe and organized evacuation.

Firefighters at all levels of the organization will be under tremendous pressure from the media, homeowners, other emergency responders, and politicians to take action and "fix the problem". This pressure can be counterproductive to incident mitigation, distracting to supervisors, and dangerous to firefighters who try to "look like they are doing something". During an incident that requires evacuations, all firefighters must make sure they are safely working to achieve the IC's overall goals while ensuring a safe evacuation, working to extinguish the fire, and defending threatened structures.

The steps outlined in this chapter are not necessarily presented in the order of completion, and should be adjusted to meet the needs of the responders and the incident. Some steps may be completed simultaneously or out of sequence.

Primary Responsibility

The law enforcement agency having jurisdiction (AHJ) over the threatened area is primarily responsible for evacuating civilian populations and domestic animals from a hazardous area, determining the level of closure, and staffing traffic control points. However, there are times when firefighters need to initiate and participate in an evacuation prior to arrival of law enforcement.

The fire agency having jurisdiction over the threatened area is responsible for notifying law enforcement and making recommendations regarding:

- Which areas should be evacuated
- Who should be evacuated, when, and where to (if shelter location is known)
- Which evacuation routes to use
- Type of protective action (evacuation order, or warning, etc.)
- Chain of command
- Animal evacuation issues
- Timeline
- Safety issues for law enforcement

Wildland fires spread rapidly and may affect several political jurisdictions concurrently. When preparing evacuation plans that may affect other jurisdictions, the IC must ensure that surrounding jurisdictions are advised of the potential threat and possible evacuation. The IC should consider entering into unified command with the affected jurisdictions and make the appropriate notifications. Law enforcement agencies and their on site supervisors will be working on many of the same tasks as the IC. The California law enforcement system uses a separate system for mutual aid. Law enforcement personnel will face many of the same challenges as the fire service regarding reflex time, radio communications, and personnel briefings during the early stages of a WUI incident.

Whether a fire threatens a single structure or an entire community, law enforcement and fire service personnel should work together to develop an incident evacuation plan. The

Figure 8.2. Evacuations affect both the human and animal populations.

Figure 8.3. Evacuations are generally the responsibility of the law enforcement agency having jurisdiction over the evacuation area. Firefighters should be prepared to assist or initiate an evacuation.

Figure 8.4 Law enforcement plays a critical role during an evacuation and should work closely with fire personnel throughout the incident.

incident evacuation plan may encompass the entire incident, or specific areas in or around the incident.

Law Enforcement Agency Having Jurisdiction

The IC should request an agency representative (AREP) from the law enforcement AHJ to respond to the incident command post, (ICP). The law enforcement AREP must be a supervisory officer with the authority to speak on behalf of the law enforcement AHJ, commit resources, and expend funds to support the evacuation effort. The law enforcement AREP should meet with the IC to be briefed on current incident status, including the expectation for containment, and what areas will be affected by the fire prompting an evacuation. The law enforcement AREP and the IC must agree on how law enforcement should be included in the command structure. On multi-jurisdictional incidents, several law enforcement AREPS may respond to the ICP possibly overwhelming the IC. Consider ordering a LOFR to assist with communications between law enforcement and the IC. Potential misunderstandings can be avoided if all the law enforcement AREPs agree to work for one law enforcement representative.

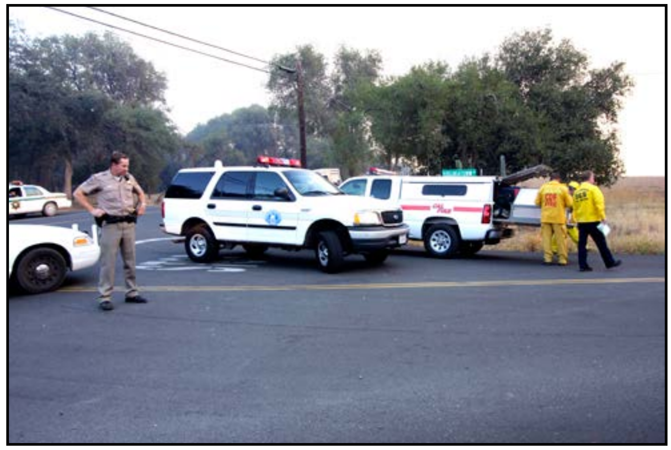


Figure 8.5. Evacuation efforts may be streamlined and enhanced when the IC and law enforcement work closely together.

There are several options for including law enforcement in a WUI incident command organization depending on the incident status. There is no single answer for every evacuation situation.

The options to choose from include:

- Integrate law enforcement into the incident command structure as a unified incident commander to work closely with the IC and operations section chief.
- Assign a supervisory law enforcement officer to the operations section as a deputy to the operations section chief. The law enforcement officer must be co-located with the operations section chief to share real-time intelligence on the fire's progression and the evacuation's progress.
- Assign a supervisory law enforcement officer to the operations section as a law enforcement branch director or group supervisor under the operations section chief. The law enforcement supervisor should be collocated with the branch directors or the division supervisor in the affected area.
- Assign a supervisory law enforcement officer to the incident as a law enforcement AREP. In this capacity, the law enforcement AREP will have the ear of the IC and will be able to voice concerns or provide intelligence and input to the IC.

Once the law enforcement agency is included in the incident organization, the IC and law enforcement representative should operate from the same ICP and co-locate mobile communication centers. Consider co-locating field operations personnel to improve communications, streamline accountability, and increase productivity. Consider co-locating staging areas emphasizing ease of ingress and egress.

Cooperating Agencies

When developing and implementing the incident evacuation plan, close coordination with the incident's cooperating and assisting agencies is critical. Staff the LOFR position early in the incident to facilitate the interaction between the IC and various AREPS. Cooperating and assisting agencies may include the California Highway Patrol, local law enforcement agencies, the Red Cross, animal control and animal rescue organizations, Caltrans, County OES, local public works departments, the Salvation Army, local building departments and safety agencies, local water departments, and utility companies.

EVACUATION PLANNING

After determining the need for an evacuation, review and activate any evacuation pre-plans. In many counties, the emergency operation plan maintained in the county's emergency operations center may also contain pre-plans and identified emergency facilities, evacuation shelters, and community safe refuge areas. The incident operations staff should confirm that the pre-plans are current and have been validated by the local resources involved in its implementation. Make copies and distribute to all appropriate personnel.

If there is no pre-existing evacuation plan, develop a plan as soon as possible. The plan should be in place before initiating any evacuations. In urgent situations when evacuations must be carried out immediately, the incident operations staff should direct suppression resources and any on scene law enforcement personnel to evacuate threatened areas as safely and quickly as conditions allow without a written plan. Suppression resources may initiate evacuations without law enforcement assistance.

Fire ground command personnel should work with the law enforcement AHJ to develop the incident evacuation plan.

All incident evacuation plans (verbal or written) should:
- Clearly identify areas to be evacuated.
- Identify which evacuation option will be used: evacuation warning, evacuation order, sheltering in place, rescue, community safe refuge area, survival area
- Identify decision points to initiate the evacuation and make them known to the appropriate line supervisor and law enforcement representative.
- Identify traffic control points and the level of closure at each point.
- Identify public evacuation routes.
- Identify travel routes for emergency responders.
- Provide contact information for assisting and cooperating agencies.
- Contain a re-population plan to safely return the public to their homes.
- Identify law enforcement and cooperating and assisting agency responsibilities.
- Utilize an early warning notification system.

Protective Actions

The 2012 *FIRESCOPE Field Operations Guide* (FOG) lists six protective actions used by fire and law enforcement agencies:

- Evacuation warning
- Evacuation order
- Sheltering in place
- Rescue
- Community safe refuge area
- Survival area

Depending on the size, type, and complexity of the emergency, all of these protective actions could be employed on the same incident.

Evacuation terminology varies from jurisdiction to jurisdiction. Firefighters should meet with the local law enforcement AHJ to verify consistency between agencies. When responding to a fire in a different jurisdiction or area, firefighters should determine early in the incident which terms to use and cooperate with the law enforcement AHJ.

Each protective action fills a specific operational need based on critical time factors and the availability of safe travel routes to shelter locations. Protective actions can and should be adjusted as incident conditions change.

Evacuation Warning

An *evacuation warning* alerts the citizens in a defined area of a potential threat to life and property from an emergency incident. The warning puts the area on standby and allows the occupants to prepare for a possible evacuation. An evacuation warning may be upgraded to an evacuation order as a result of an increased threat, or canceled if the threat is diminished. The IC usually issues an evacuation warning when an area is threatened but enough time exists to implement an evacuation. The IC implements the warning based on current and expected fire behavior, however law enforcement will be the lead agency issuing the warning and conducting the evacuation if needed.

Evacuation Warning
Alerting of community members in a defined area of a potential threat to life and property from an emergency incident.

Criteria for an evacuation warning include ample time to plan for the event, a written plan for the specific action, and close coordination and communication with assisting agencies such as law enforcement, the Red Cross, and local government officials. The written plan should also include procedures for the movement and care of special needs populations, pets, and livestock.

Figure 8.6. Anticipate extended reflex times for large animal evacuations. Consider an evacuation order for livestock in areas heavily populated with large animals even though the human population is only under an evacuation warning.

When adequate time is available, an evacuation warning is the desired protective action. Emergency resources have the time to become familiar with both the evacuation plan and the affected area, the public is warned and prepared, and if the warning is upgraded to an order, the evacuation should proceed with less confusion or panic.

Company officers or the IC may verbally advise citizens in the area to remain alert and be prepared to evacuate should conditions change. If the incident escalates a formal evacuation warning can be a powerful tool to educate the public.

Evacuation Order
Movement of community members out of a defined area due to an immediate threat to life and property from an emergency incident.

Evacuation Order

An *evacuation order* is issued when an immediate evacuation is required because of an imminent threat to life and property. Occasionally, suppression resources may be required to initiate an immediate evacuation in order to mitigate a life threat prior to law enforcement arriving on scene and assuming this role. The law enforcement AHJ is still the lead agency for the evacuation, but the IC may be required to oversee the evacuation until law enforcement units arrive.

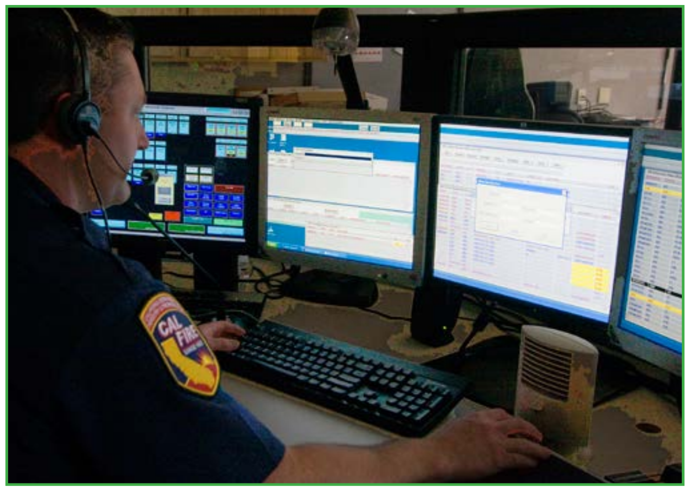


Figure 8.7. The ECC can assist the IC by notifying the law enforcement AHJ of impending evacuations or by activating the emergency alert system.

Regardless of the complexity of the area affected, these activities must be carried out as part of an evacuation order:

- Determine the potential for incident expansion and request appropriate numbers of resources, including law enforcement, to complete the evacuation and mitigate the incident concurrently. Establish an ICP and co-locate with law enforcement.
- Identify the evacuation area using a Thomas Brothers map or other appropriate, commonly used map reference and provide a map page reference and grid. Consider the area of incident potential when determining the evacuation area.
- Identify traffic control points for incident resource and civilian entry and exit.
- Identify areas that must be immediately evacuated and label as evacuation order areas.
- Identify areas that are potentially threatened and label as evacuation warning areas.
- Identify community safe refuge areas inside the evacuation areas.
- Determine, publish, and distribute evacuation routes.
- Divide the evacuation function into appropriate divisions of labor and develop an evacuation organization structure.
- Request the LOFR, the law enforcement AHJ, local OES or ECC to activate the local *emergency population warning system*. Types of emergency population warning systems include:

Emergency Population Warning System
A method or mechanism whereby local, regional, or national authorities can contact members of the public in a specific area en masse to warn them of an impending emergency or evacuation.

    - Emergency alert system
    - Commercial phone/paging/e-mail notification systems (Reverse 911)
    - Warning sirens
- Identify and clearly communicate the decision points and triggering events for designating additional evacuation areas. Evaluate the evacuation plan and expand or contract the plan as necessary.
- Identify areas of special needs populations and large animal rescue problems.
- Utilize media outlets and social media to get evacuation information out to public.

Once the public has been ordered to evacuate, they must have an evacuation route away from the affected area to a safe refuge area, an evacuation shelter, or an area outside the evacuation order area. The evacuation route must be as safe as possible, avoiding the effects of the approaching fire such as thick smoke and ember showers. Avoid using mid-slope roads and roads located above the fire. Avoid narrow, winding roads where bottle necks or gridlock may develop. Failure to provide the safest most direct route may subject the evacuation process to serious delay and expose evacuees to unnecessary danger. Consider whether traffic control will be necessary to direct evacuees, or if evacuees will be able to safely find their way on their own. Consider resource access into and civilian egress out of the area. Having separate routes for evacuees and emergency responders will minimize the potential for delays and accidents on roads and highways. Consider using multiple evacuation routes or reverse flow to increase the amount of traffic leaving an area.

Figure 8.8. Citizens must have a clear and open route to safety during an evacuation.

Reverse flow is a tactic used by law enforcement and road/highway agencies to stop the two-way flow of traffic and cause all lanes of traffic to flow in one direction. This turns two-way traffic flow into one-way traffic flow on a road or highway. This tactic increases the rate of flow and increases the ability of emergency managers to move large numbers of evacuees from one area to another rapidly. Close coordination between the IC, law enforcement, and road/highway departments is required for safe and effective use of this tactic.

Figure 8.9. A reverse flow traffic pattern on a four lane or divided highway is an excellent tactic for moving large numbers of vehicles away from an area under an evacuation order.

Once an area is evacuated, it should remain closed by authority of California Penal Code Section 409.5 commensurate with the level of closure discussed later in this chapter. Law enforcement should be posted at the entrance to any closed area and allow only legitimate access. Law enforcement should have a strong, visible presence to prevent crime and looting in evacuated areas.

The laws that authorize law enforcement to issue an evacuation order do not allow for forcible removal of civilians except to protect a crime scene or children 18 years or younger. So, while law enforcement can keep someone out of an area, they cannot, under most circumstance, remove them from that area.

Figure 8.10. The Salvation Army and other similar agencies can provide assistance to evacuees such as food, water and basic medical attention.

If a resident or civilian refuses to leave an area under an evacuation order, the emergency worker or law enforcement officer on scene should take the following steps (time permitting):

- Clearly define the threat and reasons for the order being issued.
- Give direction regarding potential safe refuge areas, escape routes, attire, and other safety concerns.
- Obtain names and contact information of civilians staying in the evacuated area.
- Advise civilians of steps they can take to potentially increase their safety (hardening the structure and increasing defensible space).
- If civilians refuse to comply with an evacuation order, note the refusal and advise the IC or other appropriate line supervisor of the non-compliance.

When civilians are ordered to evacuate, they should be given a location to report to. During an evacuation, evacuees generally stay in pre-designated evacuation shelters, with relatives or friends, or in local hotels. Considerations for a good shelter location include the size, location, and adequacy of the shelter, and safe travel routes. The Red Cross or another service organization usually provides the logistical support for evacuation shelters in California and should be contacted as soon as possible when evacuations are considered. It only adds to evacuee confusion and concern if they do not know where to go or what to expect when they get there.

Figure 8.11. Favorable geographic features, or adequate clearance around homes or subdivisions, may offer better protection to civilians if they are sheltered in place.

- Is the location available for the long term, or only short-term use?
- Is staffing for the shelter required?
- Are there accommodations for special needs persons at the shelter or will they need to be moved a second time to a

location that can accommodate their needs?
- Are pets allowed at the shelter?
- Is sanitation available?
- Will evacuees require food and water?
- Will medical services be available?
- How will the public information officer provide intelligence updates to evacuees?

Sheltering in Place

Sheltering in place involves directing civilians to remain in their current location and should only be used if civilian safety may be assured by remaining where they are. Sheltering in place must be weighed against the advantages and disadvantages of evacuating civilians from the threatened area to a *community safe refuge area* or shelter.

The risk of exposing civilians to the effects of the fire or the potential for traffic accidents may preclude an evacuation, especially if the evacuation increases the potential for the loss of life. Heavy smoke, increased traffic volume, abandoned vehicles, and general panic may make an evacuation the more dangerous option.

Sheltering in place may also be the only option when there is no time or resources available to conduct an evacuation. Favorable geographic features, adequate clearance around homes or subdivisions, or community awareness of disaster pre-planning may offer better protection to civilians if they stay where they are. As conditions change, reevaluate the decision to shelter in place versus conducting an evacuation.

Fire or law enforcement personnel must be available to provide direction and address the concerns of civilians being sheltered in place. The public will be unfamiliar with what is happening and will have a heightened sense of concern for their safety and the safety of their property and animals.

Sheltering in Place
Directing community members to stay secured at their current location. Only used if the safety of the citizens can be assured if they remain; or if evacuation will cause a higher potential for loss of life.

Community Safe Refuge Area
A temporary safe location to hold evacuees until evacuation routes are open.

Cedar Fire (San Diego County) - October 29, 2003

In 2003 the Cedar Fire burned in San Diego county. During the incident a Branch Director arrived at the Barona Casino which was in the path of the oncoming fire. Under normal circumstances an evacuation order would be issued to evacuate the 1,000 plus civilians. In this case, the exit route, Wildcat Canyon Rd, was a narrow curvy, 2 lane road. The impact of having over 1,000 people plus local residents evacuate down this road could have been catastrophic. The decision was made to shelter civilians in place at the casino. The casino was of new construction and was surrounded by a parking lot on one side and a golf course on the other. The hotel was notified and the HVAC system was shut down. Civilians were secured in the casino and the fire front passed through with no reported injuries however several vehicles were destroyed by the fire. Nine civilians, local residents not associated with the Casino, were killed on Wildcat Canyon Road as they tried to flee the fire area.

Civilians sheltered in place may also require further information and direction as events unfold or as the situation stabilizes. They should be told when it is safe to emerge from their homes or shelters, and what to expect for the immediate future.

Figure 8.12. Barona Casino where civilians were sheltered in place as the Cedar Fire spread throughout the area.

Community Safe Refuge Area

A community safe refuge area is a designated location deemed a safer alternative to shelter-in-place. It is a temporary safe location to shelter evacuees until a safe evacuation route is opened, the fire threat is mitigated, or evacuees can return to their homes. A safe refuge area differs from sheltering in place in that it removes people from their homes or current location, and relocates them to a safe area where they may remain unaffected by the fire threat.

A safe refuge area is usually a local setting such as a school, park, or mall, where neighborhood civilians may congregate not far from their homes. As with sheltering in place, strong command presence is required to maintain calm, minimize confusion, and provide clear direction to evacuees.

Company officers can successfully use community safe refuge areas during initial attack. This action usually occurs verbally and is short term. Community safe refuge areas may be formalized for specific areas on written plans produced by a team assigned to the incident, local agency emergency

Esperanza Fire (Riverside County, CA) - October 2006

The Esperanza Fire immediately threatened the community of Twin Pines, north and east of California State Highway 243, near Hurley Flats. The IC issued evacuation warnings and evacuation orders for the areas threatened by the fire. During the early hours of October 26th, the fire made a significant run, crossed California State Highway 243, and cut off the evacuation routes for Twin Pines and the surrounding area and threatened Poppet Flats as well.

The Bureau of Land Management and CAL FIRE had previously completed a number of fuel modification projects in and around Poppet Flats, improving the defensible space around the community. The area also had been pre-planned by the local CAL FIRE unit to prepare for a large fire emergency.

As the fire progressed, the residents of Poppet Flats, including Rancho Encino and the Silent Valley RV Park were sheltered in place. They also used the area as a safe refuge area for the residents of the Twin Pines and Hurley Flats area. Approximately 1,800 civilians stayed in the Poppet Flats area for 36 hours. Once safety concerns were mitigated, civilians were evacuated from Poppet Flats through Idyllwild, to the community of Hemet.

operating plans, or they may be chosen at random within a threatened area based on the current and forecasted fire behavior.

Survival Area

A *survival area* is an area that has also been deemed a safer alternative to sheltering in place. A survival area should only be used if civilians are unable to make it to a community safe refuge area.

Rescue

Rescue refers to emergency actions taken within an affected area to recover and remove injured or trapped civilians.

> Survival Area
> An area deemed a safer alternative to sheltering in place.

> Rescue
> Emergency actions taken within an affected area to recover and remove injured or trapped civilians.

Decision Points

During an **immediate need** evacuation, decision points may not be identified for the affected area. However, for a **planned need** evacuation, decision points may be identified for areas that could eventually require evacuation.

An evacuation decision point may be a critical drainage, ridge, or highway. A triggering event may be a wind shift or other weather anomaly, a significant increase in fire spread or intensity, a critical resource diversion, or a large spot fire or a new incident. Once the decision point is reached or a triggering event is evident, the IC should consider all other factors and prepare to implement the evacuation plan. Depending on the forecasted duration and scope of the incident and the probability of successful suppression efforts, evacuation planners may need to identify different decision points for different areas potentially threatened by the incident.

The planning and operations sections staff may assist in locating and identifying decision points based on the fire's current location, rate and direction of spread, and the reflex time required to implement an action. When identifying decision points for an evacuation area, the plan should detail which protective action options may be initiated once the fire reaches that decision point.

Operations staff with the IC's approval need to identify evacuation decision points that allow enough time for civilians to safely leave the threatened area and be prepared to evacuate populations sooner rather than later. Law enforcement, fire service, local emergency medical services associations

Zaca Fire (Santa Barbara County, CA) - July 2007

The Zaca Fire burned in the back country of Santa Barbara County. The incident's resources worked to stop the fire north of the city of Santa Barbara. The Santa Ynez River was designated as the River Decision Point. If the fire crossed the River Decision Point, the ICs would decide whether to issue an evacuation order for the Camino Cielo area as well as issuing an evacuation warning for the Santa Barbara front country. The same decision point (Santa Ynez River) was used to determine protective actions for other evacuation areas as well.

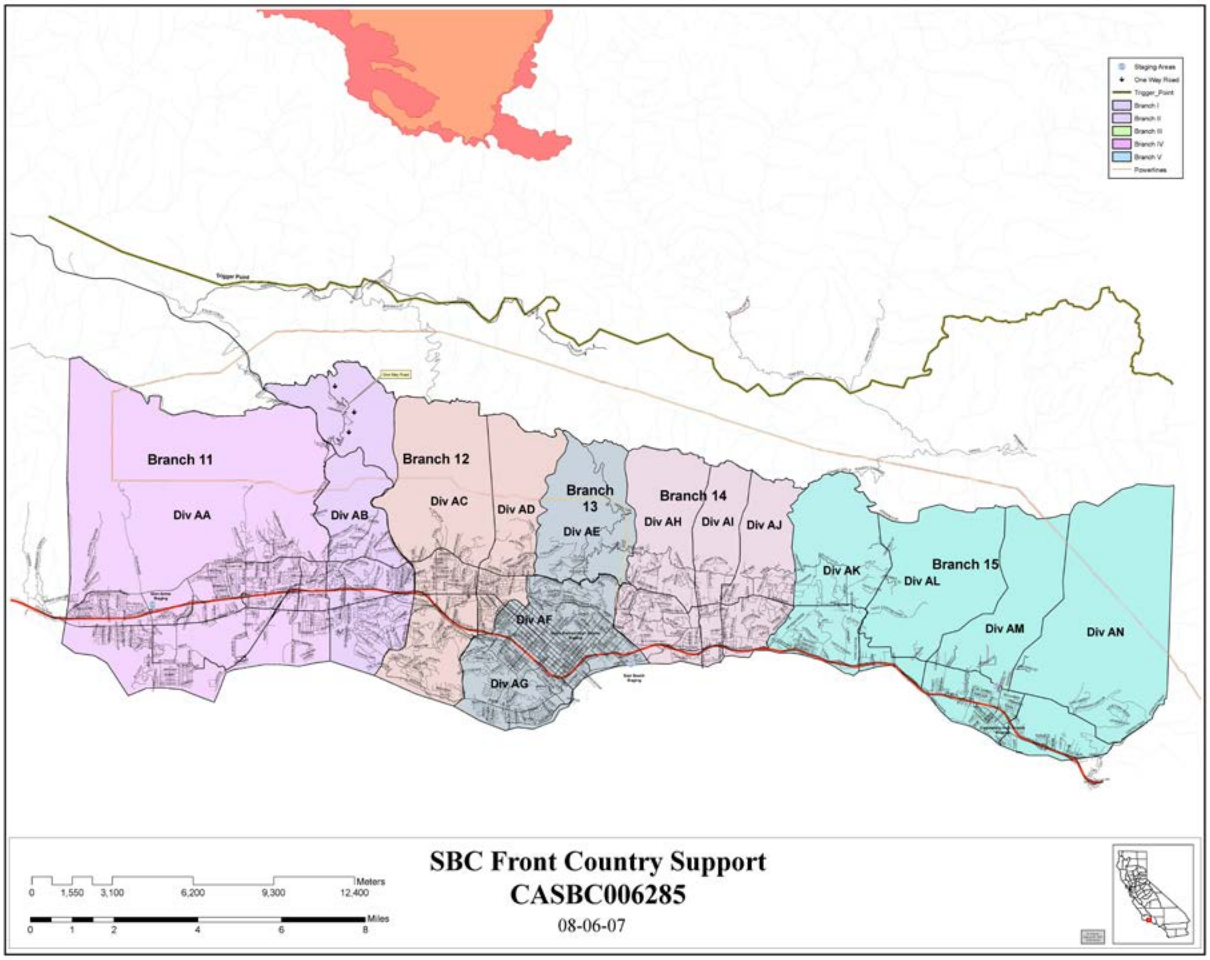


Figure 8.13. In this example of an evacuation contingency map used on the Zaca Fire, planners divided the city of Santa Barbara into evacuation zones. In the event the fire spread threatened an individual zone, that zone could be alerted and evacuated independently of non-threatened zones.

(LEMSA), animal groups, and local road or public works agencies need to work together to quickly determine the threat to the population. They must develop a plan to protect, evacuate, or shelter in place based on time frames for the threat to arrive, how mobile the population is, and any special needs populations that are threatened.

Road capacity (how fast or slow vehicles can travel and how many the road can accommodate at one time) and potential traffic demand (how many people are being moved at one time) can provide a rough idea of the minimum evacuation time. However, it can also take much longer than expected because people respond to evacuation orders in many ways using all sorts of vehicles.

When traffic congestion does occur, data indicates that it may be related to civilians waiting until the last minute to evacuate, either by choice or though a lack of notification. Studies indicate that a large percentage of civilian fatalities do not occur in or around structures, but during attempts to leave the fire area.

A decision point may be used to initiate separate actions within the same evacuation area. Using the Zaca Fire example, if the fire was to cross the River Decision Point, then an evacuation order would be issued for *special needs populations* in the front country area of Santa Barbara, but an evacuation warning would be used for the general population for the same area.

> Special Needs Population
> Any individual, group, or community whose age, physical, mental, emotional, or cognitive status, or language skills creates barriers to understanding or the ability to act/react in the manner in which the general population has been requested to proceed during all phases of emergency management.

CONDUCTING EVACUATIONS

Notifications

There are multiple ways to notify civilians of an impending evacuation warning or order. The method used depends on the amount of time emergency responders have to implement the evacuations. The simplest method in an urban area is to go door to door, or drive a street in an emergency vehicle using a public address system, directing citizens to prepare to evacuate or to evacuate to a designated area. This notification can be initiated by suppression resources prior to the arrival of law enforcement.

NOTIFICATION METHODS AVAILABLE TO EMERGENCY RESPONDERS	
The Emergency Alert System	A national public warning system that requires broadcasters, cable television systems, wireless cable systems, satellite digital audio radio service (SDARS) providers, and direct broadcast satellite (DBS) providers to provide the president of the United States with the communications capability to address the American public during a national emergency. This system may also be used by state and local authorities to deliver important emergency information, such as AMBER alerts and weather information targeted to specific areas. The incident public information officer or LOFR may facilitate access to this system.
Commercial phone, paging, or e-mail notification systems	These systems have the capability to send a voice recording up to a minute or two long to thousands of hard-line and cell-phone numbers, as well as pagers and e-mail accounts. The law enforcement AHJ or local emergency command or dispatch center should have access to these systems. Example: a public safety communications system like Reverse 911®.
Warning sirens	Located in some areas throughout the state, these sirens are activated during an emergency. Ongoing media campaigns target populations in these areas directing people to turn on certain radio or television stations when the sirens sound to receive instructions regarding the emergency. The law enforcement AHJ or the local emergency command or dispatch center should have access to these systems.
Social media outlets	Firefighters and law enforcement agencies have access to Facebook, Twitter, and other social media platforms to provide information to the public. Social media allows instantaneous information to be posted which can be used to update road closures, evacuation orders and warnings, and other important information.

Traffic Control

A *traffic control point* is a road block controlling access to an area affected by an emergency. To effectively close an area, or evacuate civilians during an emergency, it is essential to coordinate and control their movement through the use of traffic control points. Civilian movement (direction and speed) impacts not only their safety and well being during an evacuation, but also the safety, speed, and efficiency of fire suppression resources attempting to gain access to the fire area.

Trafic Control Point
A road block controlling access to an area affected by an emergency.

The law enforcement AHJ should help identify traffic control points as it is generally more knowledgeable than other agency personnel about road systems and legal authority. Face-to-face communication between fire service and law enforcement personnel will help facilitate road closures. However, radio communication can speed up the process.

Figure 8.14. Law enforcement should be used at all critical traffic control points.

The number of traffic control points will depend on the availability of law enforcement resources and the complexity of the road system. As time allows, maps and written plans should be produced and distributed to incident personnel. Any pre-existing evacuation plans addressing road closure points and evacuation routes will greatly expedite the area closure process. The rate and direction of the fire spread and where the fire front will impact a threatened area determines the priority for traffic control points.

Allied agencies (security firms and other agency personnel authorized to enforce area closures under California Penal Code 409.5) may be used at critical traffic control points until adequate law enforcement resources arrive.

The IC or Operations Chief will identify a traffic closure level for all traffic control points based on fire conditions and suppression operations in each area. The 2012 FIRESCOPE Field Operations Guide identifies four traffic closure levels associated with traffic control points starting at Level 1 and progressively becoming more restrictive through Level 4. Level 1 is often referred to as a soft closure while levels 2 through 4 are referred to as hard closures.

Figure 8.15. Road closures are high impact decisions. Face to face communication between the IC and law enforcement streamlines and clarifies the decision making process.

TRAFFIC CLOSURE LEVELS		
Level	**Color Code**	**Restrictions**
1	**Green**	A Level 1 closure restricts any civilian traffic from entering the area except for residents. Residents may be required to provide identification verifying their residency in the evacuated area. Escorts may be required and time frames for duration of stay by legitimate residents may be imposed. Agriculture workers may be allowed past Level 1 closures to attend to livestock or agricultural crops. CWCG, FIRESCOPE, and CAL FIRE policy states that private insurance fire resources may be prohibited from entering a Level 1 traffic closure.
2	**Yellow**	A Level 2 closure restricts all traffic entering the area except for fire, law enforcement, and critical incident resources. The IC identifies critical incident resources (utility companies, Caltrans, public works, water departments, phone companies, etc.).
3	**Orange**	A Level 3 closure restricts all traffic entering the area except for fire and law enforcement personnel. In some instances law enforcement traffic may be restricted if fire conditions are such that personal protective equipment or knowledge of fire behavior is a requirement for personal safety.
4	**Red**	A Level 4 closure restricts all traffic from entering the area because of life safety concerns. Level 4 closures are typically not in effect for prolonged periods. A Level 4 closure may also be initiated for other hazards such as falling rocks and trees or when there is infrastructure damage such as a burned or fire-weakened bridge, downed power lines, or other life-threatening hazard. Usually the area restriction or road closure will be downgraded when the hazard has been mitigated, allowing access for suppression and law enforcement resources.

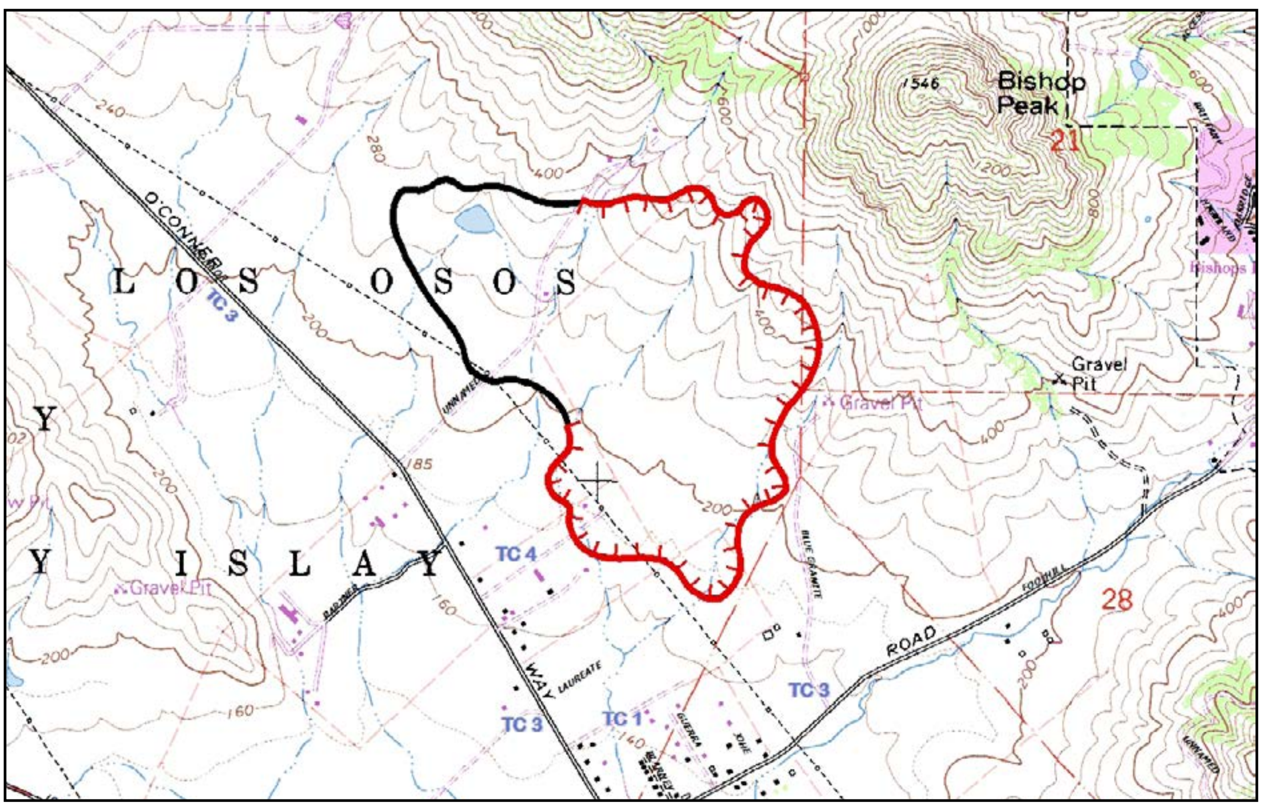


Figure 8.16. Traffic Control Point Map. Road closure maps should identify the precise location of the road closure, show all roads and population areas, and should be updated as closure status changes. The fire perimeter should also be updated on the map every operational period.

Per California Penal Code 409.5, members of the news media are allowed access under all closure levels unless there is a crime scene or their presence will interfere with firefighting operations.

Traffic closure levels may be different from point to point depending on the severity and complexity of the fire. Closure levels may also vary from area to area as conditions change. Sign boards at the traffic control points and social media can be used to provide updates and information.

When road closures affect adjoining jurisdictions, close coordination and intelligence sharing between law enforcement agencies is critical. The LOFR will need to communicate with the law enforcement branch, the incident organization, and adjoining jurisdictions to minimize confusion or miscommunication between neighboring law enforcement agencies.

On WUI incidents, the situation unit should publish and distribute maps showing evacuation routes for civilians, travel routes for emergency workers, areas under an evacuation order or warning, access control points, and levels of closure. These maps may be provided to emergency workers staffing traffic control points or used to brief elected officials and civilians at public meetings.

Information Flow

During WUI incidents, the IC should provide timely and accurate information addressing evacuations and area closures to affected resources and civilians (particularly to the evacuees), members of the media, elected officials, EOCs, and emergency workers staffing traffic control points and evacuation centers.

Figure 8.17. An information board, including an area map, maintained by the incident PIO is a helpful tool to keep elected officials, the media and evacuees informed on the fire situation and road closures.

Subjects of interest may include:

- Geographic description of the areas under evacuation orders and warnings
- Traffic control point locations
- Public shelter locations for evacuees and animals
- Estimated date and time that the closures will be lifted
- Challenges faced by emergency workers and other incident information

The incident public information officer should facilitate much of the information flow.

Information is extremely important during full evacuations when evacuees are very concerned about their homes and neighborhoods and rely heavily on the news media and posted fire information updates. The IC should ensure that the public information officer regularly updates the fire information regarding evacuations.

Repopulation

The reflex time required to open an evacuated area safely depends on the size of the area and the need to mitigate hazards that pose a safety threat to the public. It is critical to plan for repopulation as early as possible in the incident to allow civilians to re-enter as soon as possible.

Civilians will be anxious to return to their homes and get on with their lives; however, public safety must remain the top priority.

Some of the hazards that must be assessed include:

- Fire status: Is the fire threat mitigated?
- Access: Are roads, bridges, and other infrastructure safe and operable?
- Structural integrity: Are the individual structures intact and safe?
- Utilities and services: Are utilities (electricity, gas, water) safe and operable?

Incident staff, public works and utility agencies, law enforcement, and local government officials must work in close coordination to ensure that an affected area is ready for repopulation. It may be appropriate to delay repopulation until inspections are completed and the utility companies have completed any repair activities necessary to ensure the area is safe.

Figure 8.18. Generally, utilities are restored to safe operational status prior to repopulating the fire area.

Figure 8.19. Hazards such as downed power lines and unstable trees must be mitigated prior to repopulating the fire area.

After safety concerns have been mitigated, obtain signatures from each cooperator on the repopulation plan checklist verifying that their agency supports the repopulation of the area. Every stakeholder must have signatory authority. After the signatures have been obtained, the plans section will reproduce and distribute the plan to the command and general staff and other stakeholders as needed.

INCIDENT EVACUATION CHECKLISTS AND PLANS

Developing the Incident Evacuation and Repopulation Plan is usually a cooperative effort between law enforcement personnel and incident staff. Members of the planning section and operations section evaluate the incident's rate of spread, probability of suppression success, and threatened infrastructure in and around the fire area, and add this intelligence to the Incident Evacuation and Repopulation Plan.

The Incident Evacuation and Repopulation Plan will require constant re-evaluation as the incident progresses. The plan may be expanded or contracted based on current and forecasted fire behavior and possible threats to residential areas or critical infrastructure. As the command and general staff complete the planning cycle, the Incident Evacuation and Repopulation Plan should be discussed and included in the planning process.

Immediate Evacuation Checklist

The Immediate Evacuation Checklist assists law enforcement and fire agency personnel to implement an immediate need evacuation. It is designed to provide coordination and enhance effectiveness. For an example of the Immediate Need Evacuation Checklist, see the appendix page A-32.

Incident Evacuation and Repopulation Plan

Although not required, CAL FIRE strongly recommends that all agencies conducting evacuations in California use an Incident Evacuation and Repopulation Plan. The Incident Evacuation and Repopulation Plan template can be found in the appendix page A-13.

The template in this document uses 2012 FIRESCOPE terminology and standardizes evacuation procedures and terminology to expedite the evacuation and notification process. This template can assist law enforcement and fire service personnel in implementing an evacuation plan. It is designed to provide coordination and enhance effectiveness when accomplishing assigned incident objectives.

CHAPTER 9

PLANNING

During a WUI incident, the normal challenges of a wildland incident are significantly enhanced with the addition of values at risk, frightened civilians evacuating the area, and multi-agency involvement in the suppression effort. Potential ICs and company officers should develop and validate a pre-incident plan to streamline the decision-making process while collaborating with law enforcement and other assisting and cooperating agencies during an incident. ICs managing an incident should consider developing tactical structure defense plans to address structure defense in communities and subdivisions in the path of an ongoing fire.

PRE-INCIDENT PLANNING

Pre-incident planning helps all WUI responders make prompt, critical decisions about a WUI incident. A *pre-incident plan* (pre-plan) created prior to need and validated through realistic training exercises is the foundation for a safe, organized incident response. A pre-plan prepares suppression resources at all levels to respond to an incident within the planning area.

> Pre-Incident Plan
> A two part document consisting of a map and a written plan that includes, but is not limited to, notations of water sources, potential and existing control lines, hazardous areas, street locations and names, structure locations etc.

Pre-plans should include input from all agencies potentially affected by an incident in the planning area including assisting fire agencies, law enforcement, the Red Cross and Salvation Army, highway departments, public works, and animal control. Homeowner buy-in and cooperation is also essential for the implementation of a successful pre-plan. Community meetings stressing the importance of fire awareness, defensible space, the Ready Set Go program, and evacuations are one way to encourage homeowner cooperation in the planning process. Public enthusiasm for fire defense preparation is highest during the fire season when media interest is at its peak. Planners need to channel that enthusiasm into the non-fire season when most pre-plans are developed.

Figure 9.1. A town hall meeting with local citizens attended by representatives from all agencies impacted by a fire in the planning area is a good starting point for developing a WUI pre-incident plan.

Ideally, pre-planning should start during the conception phase of a new subdivision or new home construction. Building codes should reinforce fire-safe construction and firefighter safety. Defensible space laws should be enforced as part of the construction planning process. Greenbelts planted with fire-resistant vegetation and fire-resistant landscaping around structures should be encouraged whenever possible and practical. Road systems and driveways should allow easy access for emergency vehicles, provide adequate room for passing vehicles, and be clear of encroaching vegetation.

Figure 9.2. Most WUI plans are developed for existing structures, subdivisions, and communities. WUI planners should strive to work with contractors, developers and county planning departments during the planning phase of a construction project for optimal results.

Unfortunately, most major WUI fires occur in older, established subdivisions or in rural areas where pre-existing structures are located in interface conditions where little thought was given to the preservation of life and property during a wildfire.

The planning process starts by defining an area with significant fire history or fire potential. Fire history, structure density, ingress/egress, fuel loading, topography, and values at risk are some of the driving forces influencing target site selection for WUI pre-plans.

Developing Pre-Plan Maps

The comprehensive planning area map covers a wide range of features impacted by or utilized during a WUI incident, including:

- Structure locations
- Access routes and road systems
- Evacuation routes
- Special needs/concern areas
- Infrastructure
- Incident-specific information
- High hazard areas

A lot of this data can be obtained from the Geographic Information System (GIS) through government planning departments and private agencies.

Structure locations
Use GPS coordinates and street addresses to identify structure locations on the map. In densely populated areas, it is acceptable to identify a subdivision and list the number of residences within it.

Access routes and road systems

Be sure to validate GIS road layers with actual field surveys.

Evacuation routes
Develop evacuation routes in coordination with law enforcement, transportation agencies and departments, and emergency services agencies.

Special needs/concern areas
Identify hospitals, nursing homes, schools, multiple family dwellings, commercial centers, hazardous sites, and any other special concern areas. Include specific strategic and tactical direction concerning their defense.

Infrastructure
Critical infrastructure may be damaged during an incident. A power outage could affect everything from hydrants to lighting and communication. Identify major power transmission lines and facilities, water distribution networks (flumes, canals, sewer and water treatment), communication sites, underground pipelines, fuel depots and storage areas, power generation facilities, military installations, and railroad tracks and signal stations on the map and develop plans to override any system deemed critical to incident success.

Incident-specific information
Include incident-specific information on the map including potential locations for ICPs, staging areas, water sources, helicopter dip sites, control lines, and safety zones. Use proper ICS symbology and common terminology on all map notations.

- Consider safety, communications, shelter, capacity, sanitation, and parking needs when identifying potential ICP and staging area locations.
- Staging areas should be located in safe areas with adequate parking and easy ingress and egress.
- Potential water sources include municipal hydrant systems, ponds, lakes, rivers and streams, residential storage facilities, even swimming pools. Describe all accessible water sources in the map legend.
- Identify potential helicopter dip sites.
- Identify any pre-existing control lines or fuel breaks constructed in strategic locations along with their access points. Scout areas for potential control lines and give them a high priority designation on the map.
- Identify potential community safe refuge areas.

High hazard areas
Identify high hazard areas including narrow or mid-slope roads, chimneys and drainages (especially those that align with normal wind conditions in the target area), areas of dense or highly flammable vegetation, and areas with minimal clearance around structures. The map should also address hazards that impact aircraft operations including power transmission lines, convoluted topographic features that may create unusual air turbulence, and the proximity of other aircraft activity to the target area.

Additional specialized maps may be required to illustrate fire history, fuel types and ages, topography, land ownership, assessed parcel data, and other specialized information. The maps may need to

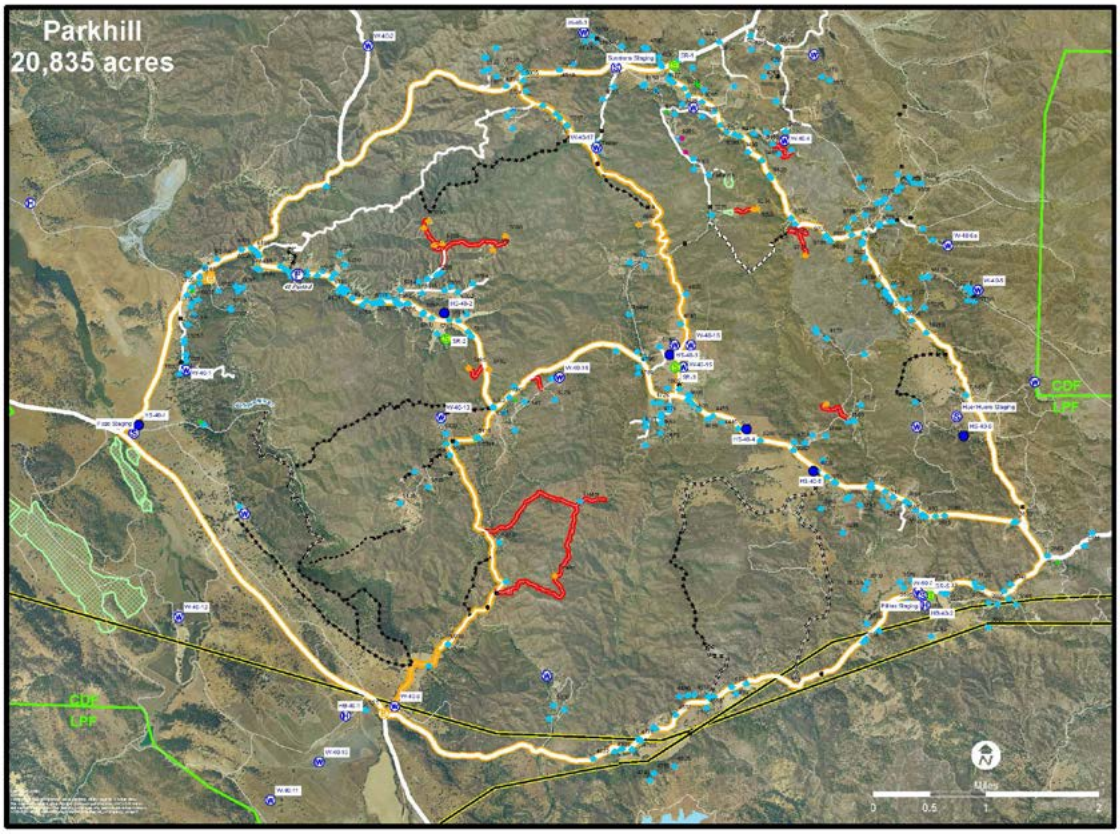


Figure 9.3. Planning maps should be easy to read and relatively uncluttered showing details that streamline the decision making process and aid responding suppression resources.

utilize different scales to capture both area overviews and detailed information.

Developing the Written Plan

The written plan supports the maps with more detailed information, guidance, and checklists. At a minimum, the written plan should include:

- A list of assisting and cooperating agencies with contact information
- A list of pre-established communication frequencies
- Potential evacuation routes and shelter locations
- Textual information to support map notations

Assisting and cooperating agencies

Include a list of assisting and cooperating agencies and the support functions they may provide, including:

- Law enforcement for road closures and evacuations
- EOCs (emergency operations centers)
- Animal control or rescue groups for evacuating or sheltering animals
- The Red Cross or Salvation Army to staff pre-identified evacuation centers and facilitate the care of evacuees
- State or county road departments to post signs showing evacuation routes or road closures and detours

- Utility agencies to shut down and repair critical utilities
- Assisting fire agencies to provide tactical support

Pre-established incident communications
Identify command and tactical frequencies, repeater tones, and any radio use limitations within the geographic area. Cell phone communication may be limited in certain areas. Contact cellular service providers to arrange for mobile cell sites to enhance incident communications. Include lists of cooperators and vendors and the services they provide along with contact names and phone numbers.

Potential evacuation routes and shelter locations
Every pre-plan should include an evacuation plan showing potential evacuation routes and pre-identified shelters and safe refuge areas. More detailed information may be included as necessary regarding:
- Areas to be evacuated
- Potential protective actions
- Potential public evacuation routes
- Potential travel routes for emergency responders
- Law enforcement and cooperating and assisting agency responsibilities
- Early warning notification systems

Textual information to support map notations
Much of the information detailed on the pre-planning maps will include additional information (contact information, capabilities, schedules, etc.) that should be included in the written plan.

A more detailed written plan might include option items such as:
- Fire history
- Incident objectives
- Command considerations
- Tactical considerations
- Contingency plans for perimeter control and structure defense
- Recommended resource order
- Weather information
- Fuels information
- Facility locations
- Staging areas
- Helibases
- Water sources
- Safety considerations
- Briefing checklists

A complete pre-plan for a small area might be a single document with a map on the front and a written plan on the back. Pre-plans for larger areas might fill a binder. Make copies of the pre-plan and distribute to appropriate personnel based on local needs. Store some in the ECC and keep some on hand to distribute during an actual incident.

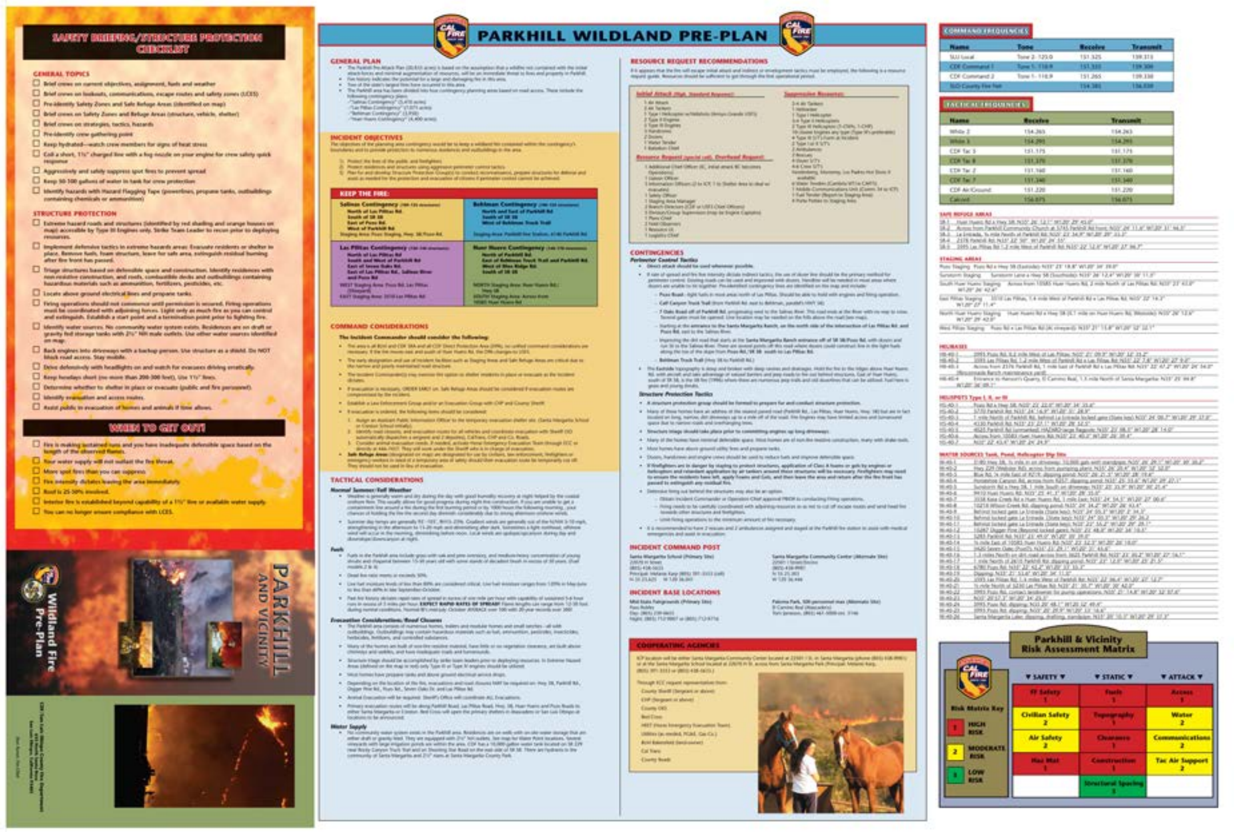


Figure 9.4. Pertinent information necessary for command decisions, and general information for suppression resources, can be either in a separate document or printed on the back side of the planning map.

Training and Validation

Once completed, the pre-plan should be validated with realistic scenario training exercises attended by representatives and resources from all agencies who may respond to an incident in the planning area. Distribute pre-plan maps to all attendees. Review and discuss the pre-plan map and written plan to ensure a common understanding of the target area including evacuation plans, access, values at risk, potential hazards, strategies and tactics, and the roles and responsibilities of each agency that may participate on a potential incident.

In some areas, agencies coordinate pre-season fire training with a multi-agency drill. This is an excellent opportunity to train on and evaluate the pre-plan. Assign resources to inter-agency strike teams and task forces to foster cooperation and teamwork. Designate strike team and task force leaders to supervise and coordinate the movement of their resources throughout the training exercise. Establish training stations at key points within the target area and rotate the strike teams and task forces through the stations focusing on safety, perimeter control tactics, structure triage, structure defense tactics, communication, and basic firefighting techniques.

Non-fire cooperators such as law enforcement and road departments may be included in the training exercise as participants or observers. A training exercise not only exposes any flaws in the written plan or planning area map, it also fosters inter-agency respect and cooperation, reducing the risk of incident-related confusion and misunderstanding at a time when inter-agency cooperation is essential to suppression efforts.

If a fire threatens an area for which there is no pre-incident plan in place, incident personnel will need to develop a tactical structure defense plan.

TACTICAL STRUCTURE DEFENSE PLANNING

A tactical structure defense plan is incident driven and produced in response to an active WUI incident threatening a community, subdivision, or area of concentrated values at risk. The plan identifies the threat to a specific area, outlines the suppression efforts required to defend the values at risk while engaging in perimeter control, and helps maintain a tactical advantage during the

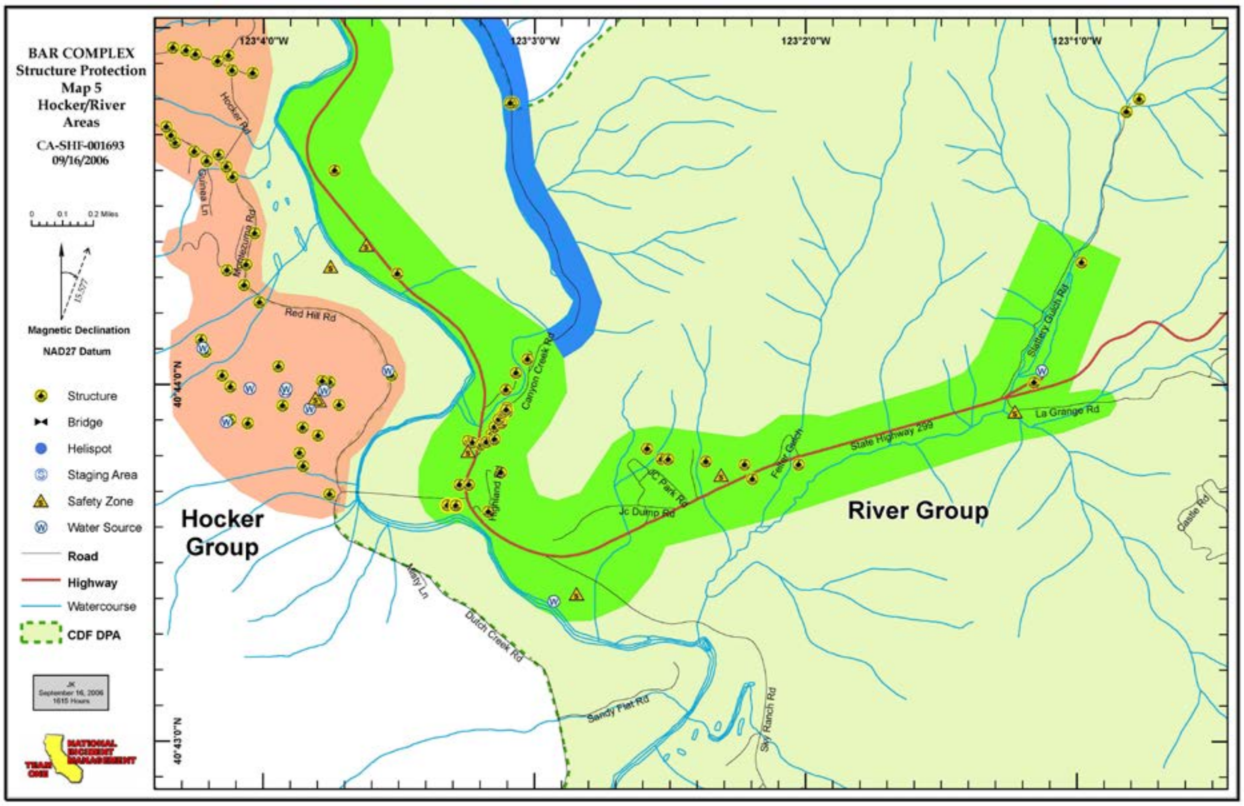


Figure 9.5. An accurate map showing roadways, infrastructure, and structure locations is a critical component of the tactical structure defense plan.

chaos of a rapidly expanding incident.

The target area map is the most critical component of a tactical structure defense plan. The map should show:

- Current fire perimeter location
- Identified decision points for plan activation
- All areas encompassed by the planning area (may require additional maps)
- Structure locations
- Infrastructure
- Specials needs/concern areas
- High hazard areas

- Proposed perimeter control lines
- Proposed branch and division breaks
- Access routes and road systems
- Safety zones and community safe refuge areas
- Traffic control points
- Evacuation zones (order or warning)
- Evacuation routes
- Incident-specific information

Different agencies and individuals will use this map for a variety of functions.

AGENCY / INDIVIDUAL	FUNCTION
Command and general staff	Planning and briefings
Incident operations personnel	Execute incident action plan
Law enforcement	Evacuations and traffic control points
Emergency operations centers	Regional planning and shelter locations
Public information officers	Media and civilian updates
Liaison officers	Cooperating agency briefings
Public works and transportation agencies	Evacuations and traffic control points

A tactical structure defense plan should also include:

- Decision points to implement different parts of the plan
- Resource needs
- Evacuation plans
- Incident-specific information
    - Projected time the fire will reach a threatened area
    - Geographic boundaries of the plan area
    - Jurisdictional authority for the plan area
- Communication frequencies
- Cooperating agency contact information

GENERAL GUIDELINES FOR STRUCTURE DEFENSE	
Isolated structures	1 engine per structure
Common neighborhoods	1 engine per 2 structures
Multi-family or commercial buildings	2 to 3 engines per structure
Strategic Reserve	Maintain 1 engine strike team or task force per division or group 1 water tender per engine strike team or task force Request enough dozers and hand crews for prep work

Because a tactical structure defense plan is developed while an incident is underway, the amount of information gathered will depend of the amount of time available before the plan must be implemented.

The tactical plan should be completed by someone with in-depth knowledge of the local fire history, fire environment, and politics. The planner should have experience with mapping programs and a solid operational and planning background.

The planner should receive clear instructions from the operations and planning section chiefs regarding who the planner is working for, time frames to produce a plan, and the geographic boundaries of the plan area. Fire, law enforcement, and other cooperating agency personnel, may work as a team to complete a tactical structure defense plan in what is usually a short time frame.

If time allows, consult with fire agency personnel with local fire history knowledge. Fire history maps are a valuable tool for this process and should be procured from the host agency's GIS (geographic information system) personnel.

Figure 9.6. The tactical structure defense planning team works closely with the operation and planning section chiefs to ensure that realistic decision points are established, adequate resources are available if needed, and time lines for implementation are met.

The planner may also obtain information from other functions within the incident organization including:

- Incident meteorologist
- Fire behavior analyst
- Operations Section Chief
- Air tactical support group supervisor
- Planning Section Chief
- Communications unit leader

If possible, the planner should observe the area from the air or drive the area using a GPS and mapping program to gather additional intelligence. The planner should take everything necessary to complete any intelligence gathering in one trip, including:

- Satellite and topographic maps
- Road maps
- A GPS unit
- Several blank copies of the Structure Defense Planning Worksheet
- Important area phone numbers
- A detailed map of the target area (if possible)

Before initiating any structure defense planning, the planner should verify whether or not a pre-plan has already been developed for the target area. If plans exist, obtain digital and paper copies and update the plans with any current intelligence. Any pre-existing plan should be validated through discussions with local fire agency representatives and an onsite review of the threatened area.

The Structure Defense Planning template and instructions can be found in the appendix pages A-22 through A27.

Approving and Implementing the Plan

The IC, Operations Section Chief, or Planning Section Chief reviews and signs the plan. In immediate need situations, the approval may be given verbally and the plan signed later. Once the tactical structure defense plan is completed, time constraints will determine which course of action to pursue:

- If the fire has already reached an established decision point, the Operations Section Chief or IC may decide to implement the plan immediately.
- If time allows, present the plan at a planning meeting for inclusion in the IAP (incident action plan) for the next operational period.
- If the plan is activated, the planner should be considered for branch director and division or group supervisor positions, if qualified, as they are familiar with both the area and the plan.

CHAPTER

10

SAFETY

It has become an all too common occurrence for firefighters to take greater risks when defending values threatened by wildfires. This significant problem must be overcome in order to minimize deaths and injuries on the fire line. Every firefighter must understand that safety is always the top priority no matter what values are at risk.

SAFETY MENTALITY

Wildland fires are dynamic, dangerous, and complex incidents that can spread across changing topography, encountering a variety of fuel types and conditions, and burn under continuously changing weather conditions. Wildland fires in the WUI present an even more complex challenge for firefighters. The presence of civilians, structures, and other values at risk compound the wildland fire problem.

Figure 10.1. Safety is a mind set. If what is being done is futile or obviously unsafe, examine the strategy and change tactics.

Firefighters must anticipate changes in fire behavior and respond accordingly, taking appropriate action to avoid injury. Conditions currently considered safe may pose a threat in the future as fire behavior changes.

The impulse to take action, coupled with a "can do" attitude has contributed to numerous deaths, injuries, and near misses on WUI incidents. While no agency demands or suggests that firefighters take extraordinary risks during WUI incidents, firefighters have a natural tendency to push the envelope when lives and structures are threatened. A "can do" attitude must be tempered with real-time fire behavior forecasting and a decision that threatened values can be defended with acceptable risk to firefighters.

Figure 10.2. An overly aggressive "can do" attitude coupled with the lack of a safety mentality and diminished situational awareness has led to serious firefighter injuries and deaths on the fireline.

It is the responsibility of all supervisors and firefighters to constantly assess their own safety and the safety of those around them. Firefighters in the WUI environment must stay alert, remain calm, think clearly, and act decisively when operating under hazardous conditions.

Figure 10.3.. The presence of burning structures and panicked citizens in the WUI prompts firefighters to adopt a "can do" attitude and take unnecessary risks.

SITUATIONAL AWARENESS

Firefighting in the WUI requires a heightened state of situational awareness. Inadequate situational awareness has been identified as one of the primary factors in fatal and near miss fires.

Situational awareness is the ability to identify, process, and comprehend the critical elements of information about what is happening with regards to the incident, allowing organizations and individuals to anticipate requirements and react effectively and safely.

Figure 10.4. Distractions such as cell phone and camera use, and media interference are threats to the enhanced situational awareness required of all firefighters in the WUI.

It is a continual process of collecting, analyzing, and disseminating intelligence, information, and knowledge of a particular situation. More simply, situational awareness is being aware of what is happening around you and understanding how information, events, and your own actions impact your objectives, both now and in the future.

Situational awareness implies that personnel know and understand the 10 Standard Firefighting Orders and how they relate to situational awareness:

- Understand their assignment #8
- Have positive accountability of subordinates #9
- Are aware of adjoining resources and their assignments #7
- Are aware of current and forecasted weather and fire behavior #1
- Maintain radio communications with subordinates and supervisors #7

Figure 10.5. Situational awareness requires all firefighters to be aware of what is going on around them and to advise others when something does not look right.

- Have identified temporary refuge areas and established escape routes to safety zones #4

In order to maintain situational awareness, supervisors and firefighters should be aware of potential sources of distraction. Technological advances such as GPS, laptop computers, digital cameras, and smart phones are useful tools on the fire ground; however these tools can also be a distraction. Unauthorized use of cell phones, cameras, or other electronic devices should not be tolerated on the fire line. They have the potential to interfere with situational awareness and compromise safety.

Monitoring tactical, command, and air-to-ground frequencies can provide advance notice of potentially dangerous situations that cannot be directly observed. However, scanning too many channels may limit the ability to receive priority communications on other frequencies. Using unauthorized frequencies can also compromise situational awareness. Firefighters engaged in communication on unauthorized frequencies are distracted from incident activity and may forget to switch back to authorized frequencies and miss critical information.

Figure 10.6. Firefighters should delay taking action when power lines are down until power company representatives advise that the power lines have been de-energized.

HAZARDS

WUI-Specific Hazards

In addition to the usual safety hazards firefighters encounter on a wildfire, WUI fires create additional safety concerns.

On a WUI incident, firefighters may encounter:

- Panicked, angry, or trapped civilians
- Civilians who refuse to evacuate structures
- Civilians creating additional hazards on roadways during an evacuation
- Animal evacuations requiring additional vehicles
- Poor ingress/egress or road grades and surfaces not designed for large fire equipment
- Hazardous materials
- Downed power lines, fuel storage tanks, propane tanks, explosives, and other hazards
- Structures as part of the fuel load
- Little or no defensible space around structures

Figure 10.7. WUI specific hazards such as thick smoke, limited defensible space, limited TRAs, escape routes and safety zones, power lines, and fuel tanks can alter a firefighters perception of what is inherently safe.

- Inadequate water supply
- Increased smoke exposure (poor visibility, carbon monoxide effects, breathing difficulties)
- Extreme fire behavior
- Concurrent structure defense and perimeter control operations
- Conflicting orders, or instructions from individuals not in the incident chain of command
- Unauthorized firing operations
- Limited options for temporary refuge areas, escape routes, and safety zones.
- Increased political pressure and media interest

These WUI specific safety hazards can alter a firefighter's perception of what is acceptably safe. Firefighters might also place additional pressure on themselves during a WUI incident, leading to increased risk. Despite these pressures, prudent action on a defensible structure should be the rule. There is no excuse for compromising safety to defend a structure threatened by fire.

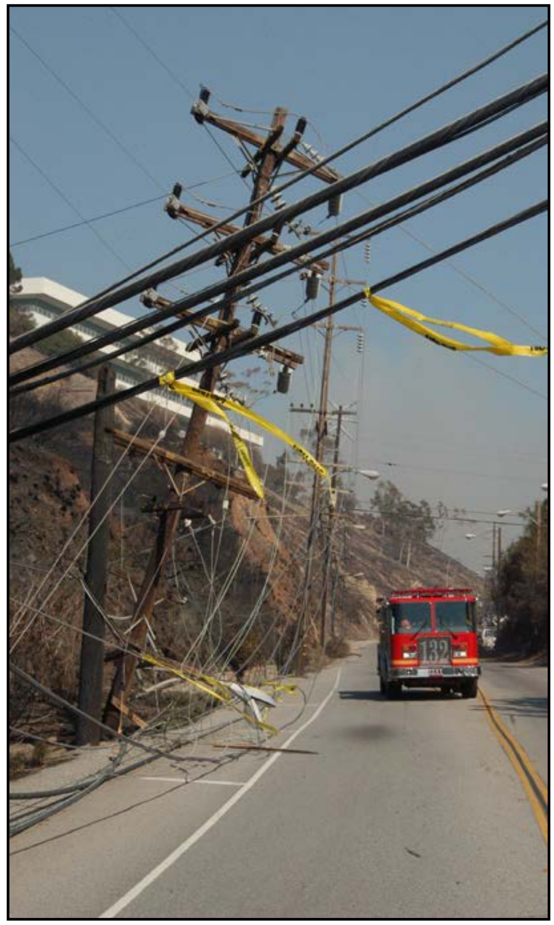


Figure 10.8. When hazards are encountered in the WUI, alert the appropriate fire line supervisors and other resources in the immediate area. Hazard identification protocol should be followed until the hazard is mitigated.

Hazard Identification

If firefighters encounter hazardous conditions (downed power lines, venting propane tanks, fire-weakened structures and trees, burned out bridges, etc.) during a fire operation, they should isolate them with barrier tape to identify the hazard area and prevent entry.

The hazard area boundary should be large enough to provide appropriate isolation, distance, and protection from the hazardous condition. Ensure that the barrier is visible enough to prevent entry, including nighttime illumination using strobe lights or glow sticks.

If the hazard area is too large to isolate, the IC should post lookouts at key points to prevent incident personnel from entering the area. Record non-isolated hazard areas on the incident map.

Maintain the hazard area for the entire duration of the incident or hazard. The IC is responsible for making sure that everyone is aware of hazard zones and the IC's approval is required before removing the barriers.

The *FIRESCOPE Field Operations Guide*, chapter 22, and CAL FIRE Policy 1738 outline detailed standards for identifying hazard areas encountered during fire operations.

Carbon Monoxide Exposure

Carbon monoxide (CO) is the leading cause of poison deaths worldwide and poses a significant risk to firefighters. CO is a colorless, odorless product of incomplete combustion. When inhaled it competes with oxygen for space on human hemoglobin molecules reducing oxygen absorption in the body. Prolonged exposure elevates blood carboxyhemoglobin (COHb) levels with multiple symptoms.

> **Because it cannot be detected by sight or smell, symptom knowledge is the most important factor when recognizing CO exposure.**

The maximum safe exposure for firefighting personnel is considered to be 5% COHb, a level achieved after eight hours of exposure at 50 ppm. The strenuous effort of firefighting decreases the amount of time it takes to reach this level.

COHb%	EFFECT
1	No apparent effect
1 to 2	Changes in behavior
2 to 5	Central nervous system effects: • Dulled senses • Vision problems • Lack of coordination • Confusion
5	Cardiac and pulmonary function changes (change in heart rate, shortness of breath)
10 to 20	Headaches, fatigue, drowsiness, nausea, dizziness
50 to 60	Intermittent convulsions
70 to 80	Coma, cardiovascular failure, death
Note: Symptoms may be present at levels below or above those indicated. Non-smokers may experience headaches and nausea at levels well below 10% COHb.	

Because no currently approved air purifying respirator provides protection from CO, firefighters must be well acquainted with and watch for the symptoms of CO exposure to avoid overexposure.

Figure 10.9. Thick persistent smoke, coupled with the byproducts of burning WUI fuels, contains significant amounts of carbon monoxide. All firefighters should know and recognize the early symptoms of CO exposure.

Heat Injury

The body is usually able to dissipate excess heat by radiation through the skin or by the evaporation of sweat. However, in extreme heat, high humidity, or vigorous physical exertion, the body may not be able to dissipate the heat. As the body temperature rises, sometimes up to 106 F (41.1 C) or higher, heat injury can occur.

Heat injury symptoms include:

- Muscle cramps
- Chills
- Dark colored urine
- Dizziness
- Dry mouth
- Headaches
- Thirst
- Weakness
- Difficulty breathing
- Dangerously high body temperatures
- Nausea
- Tingling of the limbs
- Fainting
- Extremely hot red skin

Figure 10.10. Fatigue, dehydration, poor physical conditioning, and poor nutrition are contributing factors to heat injury.

The need for multiple breaks over a short period of time can also indicate that a firefighter is suffering from heat injury.

Heat injury is preventable. To avoid heat injury, firefighters should:

- **Drink lots of water:** Supervisors should ensure that their personnel are adequately hydrated. All firefighters should limit caffeine and energy drinks which contribute to dehydration. Sports drinks have limited usefulness in preventing heat injuries as they contain a significant amount of sugar and some contain caffeine. Water is always the best option.

- **Take appropriate breaks:** ICs and supervisors should ensure that personnel take adequate rest breaks. Fire line personnel need to recognize lulls in incident activity appropriate for rest breaks.

- **Eat well and exercise:** Diet is important to preventing heat injury. On-duty firefighters have a choice of multiple food items for almost every meal and should take advantage of this selection. Do not forget to eat a balanced diet including fruits and vegetables which help improve fluid intake. Eating smaller meals can also help reduce the chance of heat cramps and indigestion. Physical conditioning is another positive way to reduce the chances of suffering heat injury.

- D**ress for conditions:** Choose appropriate PPE based on the assignment. When taking breaks, unbuckle packs, loosen clothing and remove gloves to promote cooling.

Hazardous Materials

Firefighters may encounter non-fire hazards in the WUI that require special precautions or mitigations.

Hazardous Materials

- Agricultural chemicals
- Ammunition
- Illegal dumps
- Drug labs
- Propane and fuel storage
- Power substations
- Commercial/industrial buildings

Figure 10.11. Out buildings, garages, and commercial buildings in the WUI may contain hazardous materials of all types.

If firefighters encounter hazardous materials they should first ensure crew and civilian safety. They should isolate and deny entry to the area and attempt to identify the hazard. Notify the immediate supervisor of the hazard and its location. The discovery of hazardous materials may require the appropriate fire line supervisor to divert some resources to hazard mitigation.

Figure 10.12. The by-products of burning vehicles in the WUI are very hazardous and may prompt the use of SCBAs when taking direct suppression action.

The IC is responsible for ensuring that all appropriate notifications are made through the chain of command and emergency command center. The IC is also responsible for mitigation actions related to the hazard itself which may require ordering a hazardous materials response team.

A significant hazardous materials release may require additional specialized resources not currently on the incident including: evacuations, medical treatment, victim and firefighter decontamination, and clean up and disposal of the hazardous material.

SURVIVAL TOOLS

While WUI incidents present many unique safety concerns, firefighters should always remember the basic safety considerations found in the 10 Standard Fire Orders, the 18 Watch-Out Situations, LCES, and other survival tools.

10 Standard Firefighting Orders

All firefighters must adhere to the 10 Standard Firefighting Orders on every incident.

1. Keep informed on fire weather conditions and forecasts.
2. Know what your fire is doing at all times.
3. Base all actions on current and forecasted behavior of the fire.
4. Identify escape routes and safety zones, and make them known.

5. Post lookouts when there is possible danger.
6. Be alert. Keep calm. Think clearly. Act decisively.
7. Maintain prompt communications with your forces, your supervisor and adjoining forces.
8. Give clear instructions and be sure they are understood.
9. Maintain control of your forces at all times.
10. Fight fire aggressively, having provided for safety first.

18 Watch Out Situations

The 18 Situations That Shout Watch Out identify situations that require extra diligence. They are not a signal to disengage or a reason in and of themselves to refuse an assignment. In most cases, watch out situations can be mitigated by following the 10 Standard Firefighting Orders. Firefighters must make every effort to mitigate the hazardous situation while engaged.

1. Fire not scouted and sized up
2. In country not seen in daylight
3. Safety zones and escape routes not identified
4. Unfamiliar with weather and local factors influencing fire behavior
5. Uninformed on strategy, tactics, and hazards
6. Instructions and assignments not clear
7. No communication link with crew members/supervisors
8. Constructing line without safe anchor point
9. Building fireline downhill with fire below
10. Attempting frontal assault on fire
11. Unburned fuel between you and the fire
12. Cannot see main fire, not in contact with anyone who can
13. On a hillside where rolling material can ignite fuel below
14. Weather is getting hotter and drier
15. Wind increases and/or changes direction
16. Getting frequent spot fires across line
17. Terrain and fuels make escape to safety zones difficult
18. Taking a nap near the fire line

SITUATION	POSSIBLE MITIGATION
Cannot see main fire, not in contact with anyone who can	• Position a lookout to observe the main fire • Establish radio communication
Instructions and assignments not clear	• Ask supervisor for clarification
Unburned fuel between you and the fire	• Post a look out to observe fire behavior and establish communications • Alert resources as fire behavior changes
Unfamiliar with weather and local factors influencing fire behavior	• Contact local resources • Ask local residents • Review area Fire Danger Pocket Card

If multiple watch out situations cannot be mitigated, fire line supervisors need to consider alternative options.

LCES

The LCES Checklist is another fire line safety tool. Firefighters should identify and communicate lookouts, communications, escape routes, and safety zones prior to engaging a fire in the WUI environment. These things must be continuously re-evaluated as conditions change.

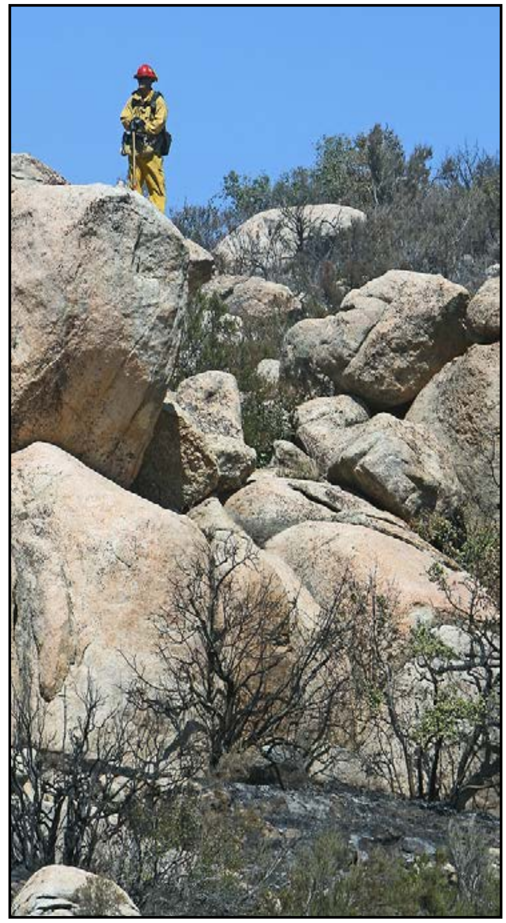


Figure 10.13. Lookouts must be seasoned, competent firefighters, able to determine if a situation is becoming hazardous, and make an immediate notification to any resources in possible danger.

Lookouts
Communications
Escape routes
Safety zones

Lookouts
Lookouts should be competent firefighters, experienced in wildland fire fighting and fire behavior forecasting. They should possess the ability to assess and monitor the fire environment while communicating any safety threats. The lookout should provide updates on conditions and fire progress and be ready to communicate the need for a withdrawal to a safety zone or temporary refuge area. There has to be at least one confirmed communication link between the lookout and the supervisor.

Communications
Communication methods include radio, audible warning signals, and authorized cell phone use.

- All forms of communications should be tested prior to deploying resources.
- Ensure that all personnel understand which signals or devices will be used.
- Only utilize radio frequencies approved by the IAP (incident action plan).
- Be aware that cell phone coverage may be limited in wildland areas.

Firefighters should monitor the assigned air-to-ground frequency even if they are not in direct communication with air resources. Information conveyed on this frequency can provide insight into fire behavior and emerging safety concerns.

A guarded frequency, which cannot be changed or turned off in an aircraft, can serve as a last resort communication link in case of emergency. Absent communication on any other frequency, use 151.220 (CAL FIRE Air to Ground) to contact CAL FIRE aircraft or 168.625 (Air Guard) to contact federal or CAL FIRE aircraft. Never use the Air Guard (168.625) frequency for tactical or command communications.

Fire line supervisors including branch directors, division/group supervisors, strike team/task force leaders, and safety officers should communicate with each other using the command frequency. Everyone should monitor the command frequency to gather critical information.

Tactical frequencies are assigned to divisions, groups, or entire branches. Although firefighters can monitor other tactical frequencies, they should only communicate on the frequency assigned to their division, group, or branch.

Support frequencies are used for communication with the Logistics Section and may be used by Operations Section personnel to request supplies, schedule deliveries, report vehicle breakdowns, and coordinate logistical support. Using this channel keeps non-emergency information off of the tactical and command frequencies.

Figure 10.14. If a TRA, escape route or safety zone cannot be established, leave the area or change tactics. A situation considered safe may become untenable requiring firefighters to withdraw.

Escape Routes

An escape route is a pre-planned and understood path of travel from a hostile environment to a safer environment. When firefighters are on foot, the escape route should be fairly short so that personnel can get to the safety zone before the fire arrives. If firefighters have access to vehicles, often the most effective means of escape in the WUI, they can utilize longer escape routes to safety zones located further away. Escape routes that deviate from an obvious path should be clearly marked.

Safety Zones

A safety zone is an area where a firefighter can survive without a fire shelter. Adequate safety zones to accommodate both personnel and equipment can be difficult to find in the WUI. As a result, firefighters should constantly look for large open areas such as parking lots, athletic fields, and parks which may be suitable for safety zones. The separation distance between firefighters and the flames should be a minimum of four times the maximum flame height.

Figure 10.15. A situation considered safe one moment may become unsafe the next moment if fire behavior changes adversely. Structure defense resources at a structure currently not threatened must remain vigilant watching for wind shifts and spot fires.

Look Up, Down, and Around

Look up, look down, and look around to evaluate fire environment factors including:

- Fuel characteristics
- Moisture

- Temperature
- Continuity
- Loading
- Terrain
- Wind
- Atmospheric instability
- Fire behavior

Common Denominators of Fire Behavior on Tragedy Fires

There are four major common denominators of fire behavior on fatal and near-fatal fires.

These fires often occur:
- On relatively small fires or deceptively quiet areas of large fires
- In relatively light fuels, such as grass, herbs, and light brush
- With unexpected shifts in wind direction or speed
- When fire responds to topographic conditions and runs uphill

Figure 10.16. Long, narrow, one lane driveways with no turnouts can compromise ingress and egress and should be scouted before committing an engine to the assignment.

Alignment of topography and wind during the burning period should be a decision point to reevaluate tactics.

Survival Facts (S-FACTS)

During a WUI incident, it may be difficult to remember all of the safety factors that must be considered. Firefighters can use the Survival Facts, or S-FACTS, memory aid to remember the safety concerns that must be addressed during structure defense operations.

Survival
Fire Environment
Access
Construction/Clearance
Time Constraints
Stay or Go

S – Survival
Firefighter survival is the primary consideration prior to engaging in structure defense operations. Firefighters must have viable escape routes to adequate safety zones and a pre-identified temporary refuge area at the structure. If a firefighter cannot survive in an area, he or she must leave.

F – Fire Environment
A situation that appears safe now may become unsafe when fire behavior changes and extreme fire

behavior can make otherwise defensible structures non-defensible, compromising firefighter safety. A thorough evaluation of the fire environment based on current and forecasted fire behavior will determine if a given location is survivable.

A - Access

When evaluating access, a number of factors can impede firefighter access to escape routes and safety zones including:

- Narrow roads or driveways
- Road grade and surfaces not suitable for heavy equipment
- Heavy fuels adjacent to or above roads or driveways
- Locked gates
- Bridges and culverts with vehicle weight limitations

Ensure that ingress and egress times are compatible with time and distance factors to an identified safety zone. As rates of spread increase, escape times will decrease. When in doubt, have a scout, field observer, or strike team or task force leader driving a light vehicle evaluate the access before deploying larger equipment.

C – Construction / Clearance

Identify and evaluate the construction materials used on the exterior of any threatened structure to determine if the structure can withstand the forecasted fire behavior while providing an adequate temporary refuge area for the firefighters defending it.

Determine if there is adequate clearance or defensible space around the structure for firefighter safety and successful structure defense. Include the protection of fire apparatus in the assessment of defensible space.

If the construction materials and defensible space around the structure are highly flammable or inadequate and there isn't enough time to prepare the structure for fire front impact, then firefighters should leave the structure.

T – Time Constraints

Monitor current fire behavior and forecast expected fire behavior to gauge when the fire front will impact the target structure.

If there is not enough time to safely evaluate, prepare, or defend a structure before fire front impact, firefighters must withdraw to a temporary refuge area or safety zone or move on to another structure.

Figure 10.17. Is there enough time to prepare the structure for defense or possibly take perimeter control action before the fire reaches the structure? If not, leave the area or change tactics.

S – Stay or Go

After considering the S-FACTs, stay if it is safe and leave if it is not.

RISK MANAGEMENT PROCESS FOR STRUCTURE DEFENSE

(from Los Angeles County Fire Department (May 2013)

To be safe, effective and efficient when undertaking structure assignments, it is essential that reliable methods are used when developing the tactical plan. By following the **Risk Management Process** (IRPG page 1) firefighters are guided through a series of steps that identify key elements of the tactical planning process. The RMP has been modified here to reflect its application when defending structures. P.A.C.E. has been included under **Hazard Control** to encourage contingency planning.

Situational Awareness

- Gather Information
  - What is the objective?
  - Who is in charge?
  - Confirm the communications plan
  - Consider local factors and fire history
- Scout (know your surroundings)
  - DO NOT ASSUME RESIDENTS HAVE EVACUATED - CONFIRM

Hazard Assessment (Inputs)

- Fire Potential Estimate
  - o Look Up/Down/Around Indicators (IRPG page 2)
- Tactical Hazards
  - o Watch Out Situations
  - o WUI Watch Outs
    - Propane tanks
    - Overhead powerlines
    - Public blocking firefighter's escape routes
    - Danger of rolling rocks
    - Structure located mid-slope or in a draw

Hazard Control (Process - These are things we must do)

- o Firefighting Orders
- o Tactical Action:
  - Check and Go
  - Prep and Go
  - Prep and Defend
  - Fire Front Following
- o P.A.C.E.

Decision Point

Are controls in place for identified hazards?

NO - Reassess situation YES - Next questions

Are selected tactics based on expected fire behavior?

NO - Reassess situation YES - Next question

Have instructions been given and understood?

NO - Reassess situation Yes - Initiate action

Evaluate:

- Maintain Situational Awareness - Are things changing?
- Are strategy and tactics working?
- Human Factors
  - o Low experience levels
  - o Distracted from primary tasks?
  - o Fatigue or stress reaction?
  - o Hazardous Attitude?

More information regarding S-FACTS as it pertains to structure triage and strategy and tactics can be found in chapter 4: Structure Triage and chapter 5: Strategy and Tactics. The S-FACTS are also included in the Structure Defense Guide

Figure 10.18. Personnel suffering heat injuries or physical injuries due to a lack of hydration or physical fitness can endanger rescuers and / or delay suppression action.

Risk Management Process

When assessing safety concerns, firefighters can utilize the basic risk management process that includes:

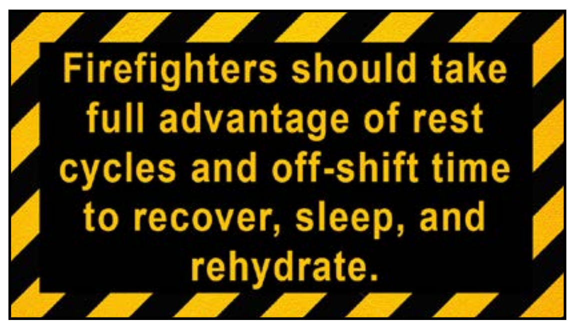
- Situational awareness
- Hazard assessment
- Hazard control
- Decision point
- Evaluate human factors and the situation

This process is included in the *Incident Response Pocket Guide* (IRPG) and the *FIRESCOPE Field Operations Guide* (FOG).

ROLES AND RESPONSIBILITIES

Personal Safety

Health and Wellness



Every firefighter should be in good physical condition and maintain a level of hydration that will prevent heat injuries on the fire line. Time spent rescuing firefighters who lack the physical conditioning to continue working or become dehydrated interrupts suppression efforts and redirects valuable resources. Situational awareness is compromised to the detriment of everyone involved in patient care as rescuers are more focused on the patient than on the fire.

Figure 10.19. A well balanced diet, along with physical conditioning and adequate rest, is crucial for personal safety.

Diet is also important to the safety and well being of every firefighter. Do not forget to eat a balanced diet. Caffeine acts as a diuretic which can cause dehydration leading to heat injuries. Coffee, sodas, energy drinks, and chocolate all contain caffeine and should be used sparingly. Energy drinks in particular have been shown to have a negative effect on personnel involved in arduous work.

Fatigue can lead to irrational decision

making and impaired judgment jeopardizing incident safety.

Personal Protective Equipment

When engaged in a WUI incident firefighters must wear the appropriate agency-approved personal protective equipment (PPE). One of the complex aspects of utilizing PPE in the wildland urban interface is the back and forth between wildland firefighting and structural firefighting during structural defense operations.

Figure 10.20. The complete wildland firefighting protective ensemble must be worn whenever engaged on a wildland fire.

Wildland Fire PPE includes:

- A Wildland Firefighting Protective Ensemble (WFPE)
- Web gear with fire shelter (Keep web gear in the apparatus, not in an outside compartment that may be inaccessible during extreme fire behavior.)
- A hydration system (separate or removable from other web gear)
- Leather gloves
- Lug soled leather boots
- A hard hat with a face and neck shroud
- Approved eye protection

Structure defense tactics can be undertaken utilizing standard wildland fire PPE. If the structure becomes involved in fire, and a decision is made to extinguish the fire, utilize the appropriate structure fire PPE including SCBAs as required.

Do not base the decision to remain at a structure or the safety of personnel on the use of SCBAs.

Figure 10.21. If the decision is made to employ interior attack tactics on an involved structure, firefighters must change to the structure firefighting protective ensemble.

Structure Fire PPE includes:

- A Structural Firefighting Protective Ensemble (SFPE)
- Insulated structure firefighting gloves
- A helmet with shroud, Nomex hood, and eye protection
- Self Contained Breathing Apparatus (SCBA)

Structure fire PPE should be available any time a supervisor believes that suppression operations will shift from wildland firefighting to exterior structure attack or from exterior to interior structure attack.

SCBAs are required for interior structural firefighting operations beyond the incipient stage. SCBAs may be necessary when conducting exterior firefighting operations if firefighters are exposed to combustion products from a burning structure.

Firefighters should not rely on SCBAs during normal WUI operations. However, they may be used in extreme life and death situations or if permitted by departmental policy. Structure fire PPE and SCBA should never be used to remain at the structure longer than it is safe. If firefighters are confronted with extreme fire behavior, excessive radiant and convective heat, or smoky conditions that exceed the protection provided by wildland fire PPE, they should change tactics or leave the area.

Incident Supervisors

All supervisors are responsible for their personal safety and the safety of the personnel under their command.

- Encourage fire season physical fitness that supports wildland perimeter control demands. Workouts should include stretching, cardiovascular activity, and resistance training. Emphasize exercises such as hiking or running over variable terrain and full-body activities that use arms and legs at the same time.
- Provide seasonal refresher training on all aspects of wildland and WUI fire operations.
- Incorporate fire line Advanced Life Support (ALS) capability into the IAP. Providing ALS improves the assessment and treatment of injured firefighters and civilians in the WUI environment.
- Provide leadership and accountability on heat stress management. Schedule appropriate rest periods and encourage hydration at all times.
- Take a proactive role in injury avoidance by identifying and mitigating risks and safety concerns both on and off the incident.
- Document and follow up on all injuries to subordinates.

Figure 10.22. The IC is ultimately responsible for mitigating hazardous situations by announcing hazards and ensuring they are appropriately marked.

Incident Commander

Ensuring overall incident safety is one of the IC's primary responsibilities. ICs need to be proactive in identifying and mitigating risks.

Figure 10.23. ICs should consider ordering ALS capable ambulances and staging them at strategic locations around the fire area for rapid response.

- Include a safety discussion in all incident briefings. Use this opportunity to emphasize the importance of adhering to the "10s and 18s" and LCES; highlight significant incident-specific safety concerns; and review the importance of hydration. If accidents or injuries have already occurred on the incident, discuss them during the briefing. Ensure review of the medical plan and injury protocols.
- Ensure that all line supervisors are aware of the assigned communications frequencies, as well as any frequency changes or additions as soon as they occur. The IC and line supervisors must monitor command and tactical frequencies for emergency communications and any critical safety information broadcast between resources on the incident.
- Continuously document incident situation and resource status. Personnel and resource accountability is critical for the safety of all personnel and efficient utilization of incident resources.
- If firefighters encounter hazards (hazardous materials, power lines, drug labs, etc.), ensure that all appropriate notifications are made through the chain of command and emergency command center. The IC is also responsible for mitigation actions related to the hazard itself.

While the IC may delegate many activities to other personnel, the responsibility for overall incident safety ultimately rests with the IC. As an incident escalates, it may be necessary to staff the incident with a Safety Officer.

Safety Officer

When assigned, the incident Safety Officer(s) helps eliminate, mitigate or reduce safety hazards by working closely with Division and Group Supervisors to develop acceptable, practical hazard mitigations.

- Develop and recommend measures for assuring personnel safety, including ordering additional line safety officers, ensuring personal accountability system is in place, ordering EMTs or paramedics.
- Assess and anticipate hazardous and unsafe situations.
- Identify and mitigate high-risk situations that could result in severe accidents.
- Develop the incident safety message.

- Confirm that the communications system is as described in the IAP or briefing.
- Evaluate traffic patterns, driving routes, and road conditions.
- Evaluate and approve the medical plan (ICS Form 206), and other emergency procedure plans.
- Utilize the ICS Form 215A, the IRPG, the Incident Action Plan Safety Analysis, and agency policy and procedures to ensure and maximize the safety effort on the incident. Identify and document safety hazards and mitigation measures for each Division, Group, or Branch.
- Investigate accidents that occur within the incident area.

Figure 10.24. An accountability system should be in place whenever multiple resources are committed to an incident, on different areas and functions of the incident such as branches, divisions or groups, and in staging areas.

Safety Officers have the full authority of the IC to stop or prevent unsafe acts.

ACCOUNTABILITY

Supervisors at every level need to know the location and assignment of all resources under their supervision. Maintaining this type of personnel, resource, and functional accountability on a WUI incident can present a challenge for fire line supervisors. Accountability systems vary and there is no universal standard within the fire service. Each firefighting resource (engines, dozers, aircraft, crews, etc.) must maintain an accountability system commensurate with its departmental policy.

Supervisors need to maintain accurate personnel rosters and document resource assignments and status on the Tactical Worksheet. Use an accountability system to track personnel and resources such as T-cards, a name tag system, or roll call.

Everyone should provide information updates on their location and status at regular intervals.

PERSONNEL	SUPERVISORS

• Check in upon arrival at the incident and check out when leaving
• Provide periodic position updates to supervisors during assignments
• Provide information on location and status at regular intervals
	• Maintain accurate personnel rosters
	• Document resource assignments and status on the Tactical Worksheet
	• Use an accountability system
	  • T-cards
	  • Name tags
	  • Roll call

Examples

- An engine checks in when it arrives at the staging area. It receives an assignment and checks out of staging. It arrives at the assignment location and checks in with the supervisor. It completes the assignment and checks out with the supervisor. It returns to the staging area and checks back in with the STAM.

- A mechanic is dispatched to change a flat tire on the fire line. The mechanic receives the assignment and checks out with the Ground Support Unit Leader. The mechanic drives to the assignment and checks in with the Division Supervisor. After completing the assignment the mechanic checks out with the Division Supervisor, returns to the incident base, and checks in with the Ground Support Unit Leader.

Emergency Traffic
The radio terminology used by incident personnel to announce an imminent or immediate life threatening situation to incident emergency personnel. This emergency traffic becomes the top priority.

Mayday
The radio terminology used as a personal declaration of an imminent or immediate life threatening situation by an individual or resource.

Radio Traffic

Incident personnel shall prioritize radio use in the following order:

1. Imminent life threat emergency or life safety hazard to incident emergency personnel
2. First report of a new incident
3. Dispatch of a new incident
4. On-going incident communications
5. Routine traffic

In the event of an imminent or immediate life threatening situation, personnel at the scene of the emergency should declare "*emergency traffic*" to announce the emergency to incident emergency personnel, the IC, and the Command Center. An emergency traffic announcement alerts field personnel to cease radio traffic on the affected frequency and await further instruction.

If the individual experiencing the life threatening situation makes the declaration, he or should use the term "*mayday*".

Figure 10.25. Every resource must check in at the ICP when they arrive at the incident. Every resource must check in with the appropriate line supervisor when they arrive at their assignment.

Agency and incident dispatch centers should broadcast the emergency traffic declaration on the command frequency. When the emergency is concluded, the dispatch center should announce a return to routine radio traffic.

Personnel Accountability Report

In the event of an incident within the incident such as a burnover, shelter deployment, or serious injury, the IC, Operations Section Chief, Branch Director, or Division Supervisor should initiate a personnel accountability report (PAR).

A PAR is a report verifying the status of personnel assigned to the incident. After a PAR is requested, all resources must report directly to their supervisor:

- "Strike Team 9224C, all personnel accounted for"
- "Task Force 2, cannot account for Dozer 4 with 2 personnel, all other personnel accounted for"

Take appropriate steps to determine the status of any unaccounted personnel.

Fire line supervisors at any level can also initiate a PAR for an engine company, crew, or any other resource any time they need to verify the status of that resource.

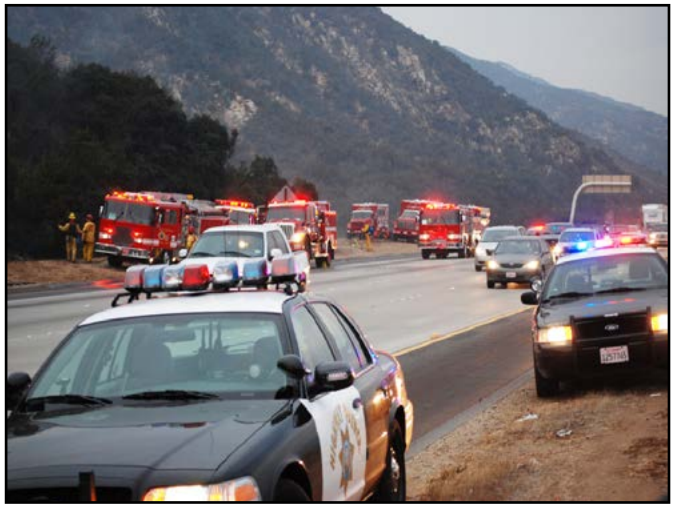


Figure 10.26. Numerous driving hazards exist for emergency vehicle operators in the WUI including high traffic volume, driver confusion or preoccupation, and poor visibility.

Emergency Signals

An emergency signal allows an officer to signal a crew to immediately return to its vehicle in case of an emergency or withdrawal from the fire ground. At the engine company or fire crew level, supervisors should discuss the emergency signal, focus training on the signaling procedure, and practice it regularly.

The *FIRESCOPE Field Operations Guide*, chapter 22, includes a detailed description of this process.

Figure 10.27. Engines traveling from structure to structure should secure hoses using WUI brackets to avoid dropping or dragging hose along the roadway.

VEHICLE SAFETY

Emergency Vehicle Operations

Emergency vehicle operation during a WUI incident is impacted by a number of variables. Firefighters must be cognizant of the following hazards at all times:

- Civilians driving on roadways in a reckless manner
- Vehicles stopped or abandoned on the roadway
- Vehicles loading animals for evacuation
- Livestock running on roadways and driveways
- Civilians walking on roadways or in driveways
- Civilians using private equipment on roadways or driveways to fight fire
- Falling trees, rocks, power lines, and power poles
- Emergency vehicles driving in an unsafe manner or blocking ingress or egress
- Fire hose on roadways and driveways
- Bridges that are not rated for heavy equipment
- Burned out bridges
- Roadways and driveways that lead to entrapment areas for firefighters
- Reduced visibility due to smoke conditions
- Slippery conditions caused by heavy retardant or foam application

Figure 10.28. Avoid serious injury by getting out of the drop zone. If a direct hit is unavoidable, immediately assume a position on the ground facing the aircraft securing tools and hard hats.

Mitigations to the hazards listed above should include:

- Drive with head lights and emergency lights on to ensure visibility
- Practice defensive driving techniques
- Always use a back-up person when backing vehicles
- Secure fire hose to engines using WUI brackets before moving the vehicle
- Flag roadway hazards and make appropriate notifications
- Do not drive over energized power lines or park apparatus under power lines
- Spot apparatus to ensure that downed power lines will not block escape routes
- Have law enforcement clear roadways and maintain traffic flow
- Use seatbelts while the vehicle is in motion

Figure 10.29. Rotor wash from helicopters can propel small rocks, sticks and other projectiles in all directions, and dislodge fire weakened trees.

Aircraft Drop Safety

The force associated with an air drop is powerful enough to cause death or serious injury. Firefighters should know when air drops are imminent and take every precaution to avoid being hit by the retardant or water.

Most drop hazards can be avoided if firefighters move out of the drop zone. If firefighters cannot leave the drop zone, they should immediately lay face down on the ground, spread eagle, facing the oncoming aircraft, while holding their hard hat on their head and maintaining control of their hand tool. Stay alert immediately after a drop for hazards that can pose serious threats including rolling rocks, falling vegetation, and slippery surfaces.

Occasionally, an air tanker will drop retardant from an altitude low enough to dislodge vegetation and rocks, damage structures and vehicles, and injure ground personnel. Immediately report low drops to the ATGS through the chain of command to correct the action.

Helicopter rotor wash may be powerful enough to dislodge fire-weakened trees or snags, raise dust, and dislodge small rocks. The turbulence from rotor wash and wingtip vortices may adversely affect fire behavior.

Other hazards associated with helicopters include cargo sling loads and crew transportation. Firefighters should avoid drop zones during bucket drops and helispots during cargo sling load operations in case the aircraft malfunctions and the pilot jettisons the bucket or sling load.

Helitack crew personnel are in charge of all aspects of crew transportation from load calculations to loading and unloading personnel. Firefighters transported by helicopter must pay attention to and follow the orders from any helitack crew member.

Figure 10.30. An aggressive direct attack at the fire's edge with "one foot in the burn" is one of the safest places for firefighters on a WUI incident.

SURVIVAL OPTIONS

In the event firefighter safety is compromised and a decision is made to take shelter from direct flame impingement, radiant or convective heat, or superheated air or gases, four options are available to firefighters depending on the situation: escape routes, temporary refuge areas, safety zones, and shelter deployment zones. Coupled with vigilant situational awareness and contingency planning these options give firefighters a safety edge during WUI operations.

Escape Routes

An escape route is an identified route used to withdraw from a tactical work area to a pre-determined safety zone or temporary refuge area.

When identifying escape routes, consider the distance between the tactical work area and the safety zone or TRA, and the amount of time it will take to travel between the two. Base withdrawal times on the slowest person's travel rate, fatigue, and the effects of high temperature.

Travel time should also be commensurate with the rate of fire spread. Firefighters must be able to reach the safety zone or TRA well in advance of the fire.

Figure 10.31. Infrastructure compounds may provide a suitable safety zone in the WUI. They should be scouted, evaluated and and announced to adjoining resources prior to need.

Ideally, firefighters should identify more than one escape route in the event that one becomes compromised. As resources move within their tactical work area, escape routes must be reevaluated and reestablished as needed.

Travel on Foot

The escape route should be clear of obstructions that could hinder a safe and hasty withdrawal. Scout potential routes for loose soil, rocks, and heavy vegetation. Avoid steep uphill escape routes.

Escape routes on foot could include driveways, roads, sidewalks, or walking paths. Escape routes might also follow the fire line, a dozer line, or a hose lay path. If no clear route exists, firefighters will need to cut a path through vegetated areas along the most direct route to the safety zone. Clearly mark all escape routes for daytime and nighttime visibility.

> **Safety Zone**
> A pre-planned area of sufficient size and suitable location that is expected to protect personnel and equipment from known hazards without using fire shelters.

When withdrawing along escape routes by foot, ensure that travel time and distance to the safety zone are realistic based on terrain, fire behavior, environmental factors, and personnel capabilities.

Travel by Vehicle

In the WUI environment, firefighters often travel escape routes by vehicle. Park vehicles faced toward the escape route; leave the engine running with the headlights on. Do not park vehicles or plan escape routes under areas with power lines.

Figure 10.32. A safety zone can be a natural clearing or an improved site.

When multiple engines are working in the same tactical area, a Strike Team Leader or Division or Group Supervisor needs to preplan emergency egress to coordinate all resources prior to withdrawal. Emergency egress should be well-timed and orderly to avoid congestion and accidents.

When withdrawing along escape routes by vehicle, there is less emphasis on the proximity of the safety zone to the tactical work area. Travel and time and distance should be based on road conditions, the number of vehicles using the same escape route, and the potential for congestion or accidents along the route.

Safety Zones

A *safety zone* is a pre-planned area of sufficient size and suitable location that is expected to protect personnel and equipment from known hazards without using fire shelters. Every incident must have one or more identified safety zones.

The size of the safety zone is determined by the observed maximum flame height. The Incident Resource Pocket Guide (IRPG) states that separation distance between the firefighter and the flames should be a minimum of four times the maximum continuous flame height. Distance separation is the radius from the center of the safety zone to the nearest fuels.

IRPG RECOMMENDED SAFETY ZONE DISTANCE AND SIZE*

Flame Height	Separation Distance (from firefighters to flames)	Area in Acres**
10 feet	40 feet	1/10 acre
20 feet	80 feet	½ acre
50 feet	200 feet	3 acres
100 feet	400 feet	12 acres
200 feet	800 feet	46 acres

*Calculations are based on radiant heat only and do not account for convective heat from wind and/or terrain influences. Since calculations assume no wind and no slope, safety zones downwind or upslope from the fire may require larger separation distances.

**Area in acres is calculated to allow for distance separation on all sides for a 3-person engine crew (1 acre is approximately the size of a football field, or 208 feet by 208 feet).

Escape time and safety zone size requirements will change as fire behavior changes. If the fire has the ability to burn completely around the safety zone, this distance must be maintained on all sides of the safety zone, meaning the diameter should be twice the value indicated above. Convective heat from wind or topographic influences will increase this distance requirement. Firefighters should remember that safety zones should be large enough to accommodate fire apparatus in addition to all personnel.

Figure 10.33. Apparatus should be parked in a safe area should the need arise to use the vehicle as a TRA.

Safety zones that meet the IRPG criteria (four times the flame height) are rarely present in the WUI, where housing density and small parcel sizes preclude the existence of large open areas. It is also difficult to construct adequate safety zones in the WUI without destroying residential improvements, however there are areas that can function as a safety zone:

Potential safety zones:

- Any area without flammable vegetation (rock slide, bodies of water, wet meadows, cleared open space, greenbelts)
- Large parking lots
- School/athletic fields
- Parks with open grass areas
- Previously burned areas with no flammable overstory (canopy)

If firefighters are unable to withdraw along an escape route to a safety zone they should withdraw to a temporary refuge area (TRA) until it is safe to either move to the safety zone or return to their task.

Temporary Refuge Areas

A *temporary refuge area* is a pre-planned area where firefighters can immediately take refuge for temporary shelter and short-term relief without using a fire shelter. Anything that protects firefighters from radiant or convective heat should be considered a temporary refuge area.

Temporary Refuge Area
A pre-planned area where firefighters can immediately take refuge for temporary shelter and short-term relief without using a fire shelter.

The purpose of the TRA is to have a predetermined rally point identified that firefighters can reach quickly and reassess their situation. If it is determined that the TRA will not provide sufficient protection from the fire's potential then firefighters should immediately withdraw along their escape route to the safety zone, or in a worse case deploy their fire shelter. Anytime there is doubt about the safety of the crew, firefighters should immediately attempt to withdraw.

Figure 10.34. Cul de sacs are excellent choices for TRAs for personnel and equipment.

Temporary refuge areas may not provide adequate safety and protection for the entire duration of need because of changing fire conditions, especially during periods of extreme fire intensity.

A temporary refuge area does not meet all of the requirements for a safety zone, but will provide an acceptable margin of safety for short periods of time. Unlike a safety zone that may be some distance away from the tactical work area, a temporary refuge area should always be on-site so that firefighters can quickly secure short-term relief from unexpected flare ups or adverse changes in fire behavior.

A temporary refuge area is not a replacement for an identified safety zone. A temporary refuge area always requires another planned tactical action in the event the temporary refuge area becomes unsafe. All personnel must be able to identify their safety zone(s).

Firefighters who take shelter in a temporary refuge area must have a contingency plan in place in the event they are forced to abandon their position.

For example, firefighters taking temporary refuge inside a structure must plan their next move in case the structure begins to burn and they cannot remain inside. This may mean moving to a vehicle or engine, sheltering behind a wall or rock outcropping, or as a last resort, deploying shelters.

Always Have an Exit Strategy
- Employ tactical maneuver to avoid injury, move away from the fire
- Move to a temporary refuge area
- Withdraw along an escape route
- Move into a safety zone

Potential temporary refuge areas:
- Large turnouts, cul-de-sacs, or parking lots
- On-site greenbelts, meadows, pastures, large lawns
- Lee side of structures
- Inside apparatus
- Inside structures

Based on the fire conditions at any given time, some options will be safer than others. The best option is the one that offers the greatest chance for survival.

When using a temporary refuge area, the crew should stay together, keeping close account of all crew members. Firefighters should follow crew leader/supervisor directions and maintain contact with their fire line supervisor. Provide supervisors with situation details, an accurate description of the location, and how to access it. Request ground and/or air support and rescue resources if needed.

When the threat subsides, personnel should evaluate one another for injuries and provide treatment as necessary. Update the appropriate fire line supervisor of the crew's status and any additional resource needs. If appropriate take suppression actions on the structure or surrounding vegetation. When safe to do so, reengage or move to the safety zone, depending on conditions.

A review of near-miss and fatality fires reveals that many wildland firefighters have abandoned or ignored temporary refuge areas offering suitable protection from radiant and convective heat while

Esperanza Fire (Riverside County, CA) - October 2006

During the Esperanza Fire an engine crew successfully used its engine as a temporary refuge area minutes before a sustained fire run caused multiple firefighter fatalities. While the fire front pushed past structures, the engine crew used the engine to avoid blowing embers, extreme fire conditions, and high winds.

en route to a safety zone. Some wildland firefighters have been killed or injured in chutes, saddles, or areas of thick vegetation while en route to a safety zone when they could have waited a minute or two in a temporary refuge area prior to moving through a more dangerous area to access the safety zone.

Using Apparatus as a Temporary Refuge Area

As a temporary refuge area, a vehicle can provide tactical mobility as well as limited protection from radiant heat, blowing embers and dust, smoke, and other hot gasses.

When determining whether or not to use a vehicle as a TRA, consider:
- Fire behavior, intensity, and rate of spread
- Vegetation clearance around the vehicle
- Fuel type (grass vs. heavy fuels) and loading
- Duration of exposure to heat and direct flame impingement
- Proximity to concentrated heat sources

Figure 10.35. Location is critical when an engine is used as a TRA. Operators must be prepared for an alternate tactical action should conditions deteriorate.

To prepare a vehicle for use as a temporary refuge area, firefighters should:
- Park the vehicle facing in the direction of the escape route
- Run the engine at a high idle to prevent stalling(1,000 rpm minimum)
- Close all windows
- Deploy fire shelters over windows if necessary
- Turn on all lights including headlights and emergency lights
- Be prepared to remove deployed hose lines
- Take structure fire PPEs, SCBAs and drinking water into the cab
- Be prepared to move the vehicle to the safety zone as conditions permit
- Notify supervisor that vehicle is being used as a temporary refuge area

Using a vehicle as a temporary refuge area requires another planned tactical action in the event that conditions deteriorate. The vehicle operator must be prepared to move to another temporary refuge area or use an escape route to withdraw to a safety zone if safe to do so.

Recent studies have shown that when exposed to periods of intense heat, conditions inside the cab of a fire apparatus may become untenable. Door handles made of plastic may fail, plastic components such as seats, and door panels may give off toxic fumes, windows may fail. If these conditions occur, firefighters may need to:
- Move the apparatus to a safety zone
- Abandon the apparatus and move on foot to the safety zone via the escape route
- Abandon the apparatus and deploy shelters outside the cab or move to a safer location to deploy

Firefighters must be aware of their surroundings and if these conditions are present they will need to quickly move to abandon the apparatus taking with them as many survival tools as described above (SCBA, fire shelters, turnouts, etc.). Some agencies may have a policy that precludes the use of the vehicle as a refuge.

Using a Structure as a Temporary Refuge Area

A structure can provide some protection from radiant and convective heat, blowing embers and dust, smoke, and other hot gasses.

Figure 10.36. When using a structure as a TRA, another planned tactical action is required should the structure ignite.

When determining whether or not to use a structure as a temporary refuge area, consider:

- Fire behavior, intensity, and rate of spread
- Flammable construction features
- Vegetation clearance around the structure
- Fuel type (grass vs. heavy fuels) and loading
- Duration of exposure to heat and direct flame impingement
- Proximity to topographic features (chimneys, drainages, slopes, ridges)

To prepare a structure for use as a temporary refuge area, firefighters should:

- Close all windows and doors
- Remove flammable materials from windows
- Close heavy drapes
- Turn on all lights, even during the daytime
- Apply a Class A foam or gel on the structure's exterior (time permitting)
- Fire around the structure (if appropriate)
- Deploy hose lines and garden hoses through openings on the least involved side
- Take structure fire PPEs, SCBAs, and drinking water into the structure
- Enter the structure and move to the furthest point from the fire
- Identify alternate exits
- Notify supervisor that structure is being used as a temporary refuge area

Using a structure as a temporary refuge area requires another planned tactical action in the event that conditions inside the structure deteriorate. Firefighters must be prepared to leave the structure to move to another temporary refuge area or use an escape route to withdraw to a safety zone if safe to do so. Do not use a structure as a substitute for identifying and utilizing viable escape routes and safety zones.

Shelter Deployment Zones

Shelter deployment zones are areas where firefighters deploy fire shelters as a last resort to avoid injury or death. Use a shelter deployment zone when fire conditions compromise escape routes, temporary refuge areas, and safety zones. Shelter deployment zones are only used when there is no other alternative for survival.

When choosing a shelter deployment zone avoid topographical features that funnel heat and smoke (chimneys, drainages, saddles), heavy vegetation, snags, and concentrated heat sources (burning structures, piles of debris). Seek out flatter areas, or the lowest point available, with minimal vegetation and choose a surface that allows the fire shelter to seal itself to the ground.

When deploying a shelter:

- Stay together and maintain communication
- Clear surface vegetation from a 4x8 foot area for each shelter
- Enter the fire shelter before fire front impact
- Lay face down with feet positioned toward the fire
- Keep face close to the ground and protect airway
- Secure the fire shelter

Sheltered firefighters should anticipate:

- Extremely heavy ember showers
- Superheated air blasts preceding fire front arrival
- Deafening noise
- Powerful turbulent winds striking the shelter
- A fiery orange glow inside the shelter
- High temperatures
- A lengthy stay
- Injuries

Figure 10.37. Although considered a last resort for shelter deployment, bodies of water such as swimming pools, lakes, ponds, rivers and creeks should not be overlooked as potential deployment zones.

Sip water and maintain communications with supervisors and other sheltered firefighters. Communication is critical for maintaining morale, composure, and safety. Firefighters should be prepared to move around within a deployment zone to minimize exposure to radiant heat or other hazards such as burning vehicles or falling trees or power poles. When moving to another location, airway protection is vital for survival.

Deploying a Shelter in a Body of Water

Although firefighters should never plan to deploy in bodies of water, they can serve as a last resort deployment zone.

Water Deployment Zones

- Swimming pools
- Lakes
- Ponds
- Rivers
- Streams
- Creeks
- Wet boggy areas

Seven Oaks Fire (Inyo County, CA) - July 2007

When nine firefighters were overrun by the Seven Oak Fire, they sought refuge in a small 60- by 40-foot pond where they deployed their fire shelters for protection. All nine firefighters walked away from this potentially deadly entrapment with relatively minor injuries.

If firefighters decide to enter a body of water for shelter deployment they should discard their tools, remove heavy packs, and enter the water with their fire shelters ready to deploy.

Entering the body of water does not protect the airway from radiant and convective heat if the head is exposed to the fire environment. To protect their airways, firefighters must keep their heads above water and deploy their shelters. By resting the fire shelter on top of their hard hats and holding the shelter's sides down underneath the water, they can create a seal between them and the fire environment. In this scenario it is possible for two or three individuals to share one shelter. Firefighters can also use the shelter as a shield to create a heat barrier if the radiant or convective heat is only impacting them from one direction.

Figure 10.38. Safety zones can be created during entrapment situations by firing out in light flashy fuels.

Water deployments should always be a last resort as they create additional safety risks due to possible swift currents, deep water, prolonged exposure to cold, electrocution from falling power lines, and hazardous material exposure. Not everyone knows how to swim and those who can will be hindered by heavy wet clothing and boots, increasing the chance of drowning.

Firefighters must evaluate all available options before deploying a fire shelter. If firefighters choose a water feature as the best alternative, they should be prepared for the challenges of deploying in water.

ENTRAPMENT

Entrapment describes a situation where personnel are unexpectedly caught in a fire behavior-related life-threatening position where planned escape routes and safety zones are absent, inadequate, or have been compromised.

Entrapment occurs when firefighters are unable to avoid fire front impact. In this situation, firefighters have two options: take shelter in a temporary refuge area (a sheltered area, a structure, a vehicle) or resort to fire shelter deployment.

Contributing factors that lead to entrapments on WUI incidents include:

- Exposure to carbon monoxide compromising the decision-making process
- Heat injury
- Poor selection of escape routes and safety zones
- Failure to understand assignment
- Lack of LCES
- Failure to recognize and react to changing fire conditions or dangerous situations
- Lack of understanding of fire behavior
- Extreme fire behavior events
- Poor visibility due to terrain, fuels, or smoke
- Trying to outrun a fire going uphill
- Setting a backfire or burning out in a manner that jeopardizes adjoining forces

To increase the opportunity for survival during entrapment, firefighters can:

- Physically position themselves to best withstand fire front impact
    - Avoid dangerous topographic features and other hazards
    - Seek out the most level terrain available
    - Avoid heavy fuel loading
    - Maximize heat shielding using embankments, structures, vehicles, or large rocks
- Consider firing out around the location (time permitting)
- Contact their supervisors and request assistance
- Protect their airways
    - Breathe shallow
    - Stay close to the ground
- Maintain communication and command presence

Figure 10.39. Entrapment avoidance means planning for what COULD happen by parking equipment in safe areas for temporary shelter or escape.

After the fire front passes, firefighters should account for all personnel and administer or seek medical assistance. Provide the immediate supervisor with a crew status update including any additional resource requests. After any entrapment, the IC should initiate an investigation and consider the need for critical incident stress debriefings.

> **Firefighters must learn from accidents and near misses to avoid repeating past mistakes.**

While all entrapments are potentially life threatening, not all lead to injury and death. Firefighters can survive, and even avoid entrapment, by utilizing established safety tools and survival sites.

Utilizing the safety tools and concepts outlined in this chapter with a strong emphasis for firefighters to use the Risk Management Process, 10 Standard Fire Orders, the 18 Situations that Shout Watch Out, and LCES combine to keep safety in the forefront of fire operations, reducing entrapments, injuries, and fatalities.

Entrapment Lessons Learned

Entrapment has led to firefighter deaths and injuries, and fire apparatus damage or destruction. Past accidents and near misses have resulted from firefighters failing to:

- Correctly forecast fire behavior
- Recognize extreme fire indicators
- Assign competent lookouts
- Maintain communication with all personnel
- Identify adequate escape routes and safety zones
- Follow one or more of the 10 Standard Firefighting Orders
- Identify one or more of the 18 Situations that Shout Watch Out
- Maintain situational awareness
- Utilize proper PPE
- Resist public pressure or emotion leading to dangerous tactical decisions

Entrapment Avoidance

Entrapment avoidance is a clear priority on any wildland fire but even more so during a WUI incident where citizens evacuating the tactical area, numerous emergency vehicles traveling in different directions, and the specter of homes burning and extreme fire behavior are distractions that can easily compromise situational awareness. The adage “Expect the unexpected” has never been more apply applied than in the WUI theater. Entrapment avoidance means anticipating what might happen. Training, experience and instinct combine to form a skill set critical for entrapment avoidance.

Skills needed to avoid entrapment:

- Heightened situational awareness
- Anticipation of changes in fire behavior
- Selection of safe, effective strategy and tactics
- Decisive tactical engagement, when or when not to engage
- Establishment and monitoring of realistic decision points
- Recognition of good safety zones, escape routes and TRAs

There are numerous safety tools available to all firefighters to help build this skill set:

- Assess potential risks using the Risk Management Process

- Know and follow the Ten Standard Firefighting Orders
- Know and recognize the 18 Situations That Shout Watch Out
- Know and recognize the Common Denominators of Fire Behavior on Tragedy Fires
- Ensure that LCES is used throughout the entire engagement
- Use the Look Up, Look Down, Look Around indicators for fire behavior forecasts

Entrapment avoidance means seeing, not just looking; listening, not just hearing:

- Always monitor the air to ground frequency assigned to the incident for alerts of hazardous situations
- Avoid long drawn out radio conversations
- Use only radio frequencies assigned to the incident
- Monitor the weather by recognizing changes in the wind, temperature and relative humidity; watch for thunderstorm development or other cloud types indicating a possible weather change

Above all, heightened situational awareness is crucial for entrapment avoidance:

- Stay focused
- Avoid distractions
- Filter unnecessary information
- Always have contingency plans in place
- React decisively to adverse situational changes
- Establish decision points and triggering events for disengagement or retreat

These entrapment avoidance skills and tools should be applied to any discussion or analysis of fatal or near miss fires.

THE SCIENCE AND ART OF FIRE SUPPRESSION

Fire suppression is both a science and an art, combining knowledge and skill with intuition and instinct. Firefighters are consistently challenged with balancing these elements in their day-to-day operations. When it comes to life and death situations, firefighters have a matter of seconds to make a decision based on experience, training, current conditions, and personal conviction.

The more command presence, situational awareness, fire behavior forecasting, structure triage, strategy and tactics, and operations in the WUI environment are understood, the more prepared firefighters will be to make that decision.

APPENDIX

Items arranged in order of appearance in book.

IRPG BRIEFING CHECKLIST

BRIEFING CHECKLIST

Situation

- ☐ Fire name, location, map orientation, other incidents in area
- ☐ Terrain influences
- ☐ Fuel type and conditions
- ☐ Fire weather (previous, current, and expected)
  Winds, RH, temperature, etc.
- ☐ Fire behavior (previous, currrent, and expected)
  Time of day, alignment of slope and wind, etc.

Mission/Execution

- ☐ Command
  Incident Commander/immediate supervisor
- ☐ Leader's intent
  Overall objectives/strategy
- ☐ Specific tactical assignments
- ☐ Contingency plans

Communication

- ☐ Communication plan
  Tactical, command, air-to-ground frequencies
  Cell phone numbers
- ☐ Medevac plan

Service/Support

- ☐ Other resources
  Working adjacent and those available to order
  Aviation operations
- ☐ Logistics
  Transportation
  Supplies and equipment

Risk Management

- ☐ Identify known hazards and risks
- ☐ Identify control measures to mitigate hazars/reduce risk
- ☐ Identify trigger points for reevaluating operations

Questions or Concerns?

Figure A.1. Back flap of Incident Response Pocket Guide, NWCG, January 2010.

IRPG RISK MANAGEMENT

Risk Management

Situation Awareness

Gather Information

- ☐ Objective(s)
- ☐ Communication
- ☐ Who's in Charge
- ☐ Previous Fire Behavior
- ☐ Weather Forecast
- ☐ Local Factors

Scout the Fire

Hazard Assessment

Estimate Potential Fire Behavior Hazards

- ☐ Look Up/Down/Around Indicators

Identify Tactical Hazards

- ☐ Watch Outs

What other safety hazards exist?

Consider severity vs. probability?

Hazard Control

Firefighting Orders → LCES

- ☐ Anchor Point
- ☐ Downhill Checklist (if applicable)

What other controls are necessary?

Decision Point

Are controls in place for identified hazards?

NO - Reassess situation YES - Next question

Are selected tactics based on expected fire behavior?

NO - Reassess situation YES - Next question

Have instructions been given and understood?

NO - Reassess situation YES - Initiate action

Evaluate

Human Factors: Low experience level?
Distracted from primary tasks?
Fatigue or stress reaction?
Hazardous attitude?

The Situation: What is changing?
Are strategy and tactics working?

Figure A.2. Risk Management, Incident Response Pocket Guide, NWCG, January 2010.

ICS FORM 215W

The ICS Form 215w can be found at http://www.firescope.org/ics-forms.htm.

OPERATIONAL PLANNING WORK SHEET

1. Incident Name	2. Date Prepared	Time Prepared	3. Operational Period (Date/Time)

4. Division/ Group or Other Location	5. Work Assignments		Resource by Type (Show Strike Team as S/T) Engines 1	Engines 2	Engines 3	Engines 4	Water Tenders 1	Water Tenders 2	Water Tenders 3	Hand Crews 1	Hand Crews 2	Dozers 1	Dozers 2	Dozers 3	Helicopters 1	Helicopters 2	Helicopters 3	Helicopters 4	1	2	3	6. Overhead	7. Report Location	8. Report Time
		Req																						
		Have																						
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9.	Total Resources - Single	Req																						
		Have																						
		Need																						
	Total Resources - Strike Teams	Req																					Prepared by (Name and Position)	
		Have																						
		Need																						

ICS 215W 3/2007

ICS Form 215W.

INCIDENT FIRING PLAN EXAMPLE

Lockheed Incident

Lockheed Incident Firing Plan

OVERVIEW

Except where immediate firing is necessary to prevent the loss of life or major property damage, all firing operations shall be communicated to the appropriate ICS supervisor prior to the commencement of the firing operation. The officer supervising the firing operation shall remain in communication with his/her ICS supervisor and adjoining forces to the extent possible.

Location: Branch III, Div X, Molina Creek Drainage

Date: 8-17-09 thru 8-22509

Time: 1400-1900

Objective:

1. Assets at Risk: Coastal Redwoods
2. Operational Objectives: keep fire contained to the dozer lines in Div. X
3. Management Objectives: low intensity fire, not to scorch old stand of Costal Redwoods

INCIDENT AUTHORITY 7013.4.2

(No. 1 November 2005)

The Incident Commander has the overall authority and responsibility to set a backfire or burn should the need exist. As the incident organization expands, the responsibility and authority to backfire or burnout may be delegated. A normal progression of delegation, depending on the complexity of the incident, would be from the Incident Commander to the Operations Section Chief and could extend down to the Branch Director, Division Supervisor, Strike Team Leader, Task Force Leader or Single Resource.

Safety will be the first priority. All personnel will closely follow the 10 standard Fire Fighting Orders, 18 Watch Out Situations, and LCES. A qualified firing group supervisor working under the direction of the Branch Director/ Division Supervisor and Operations Chief will supervise firing operations.

The following general guidelines will be followed:

- Firing will move as fast as dictated by the current conditions.
- Only those areas necessary for successful fire control should be ignited.
- Weather will be monitored continuously for changes.
- The firing group supervisor will use necessary-firing devices. Aerial ignition will be used only as necessary to support hand firing.
- Adjacent divisions will be briefed on the firing plan.

Lockheed Firing Plan Page 1 of 3.

INCIDENT FIRING PLAN EXAMPLE - Page 2

Lockheed Incident

- Crews will be prepared for a long shift (16+ hours) to complete operation.
- Contingency lines and trigger points will be identified.
- A test fire may be conducted prior to beginning operations.

Test Firing Plan
The size and location of the test burn will be large enough and representative of the fuels of the proposed burn area.

Communications:
A radio net announcement at the incident will be made prior to firing operations. This will be communicated on tactical and command nets and will identify general location of geographic area to be burned. Special frequencies may or may not be used.
Frequencies:

1. Firing Group Tactical
2. Air to Ground
3. Aerial ignition discreet frequencies:

Slop-overs and Escapes:
If an escape/slop-over occurs notify the Division/Group Supervisor, who will take appropriate suppression actions. The Firing Group Supervisor will evaluate whether or not to continue firing and communicate such to the Division Group Supervisor. At all times, appropriate information will be transmitted through the chain of command to the Operations Section Chief.

Perimeter Firing Sequence:
The perimeter firing will proceed as follows:

Firing will take 2-5 days; this is because the burn window is short, approx. 3-4 hours per day. The fuel is Costal Redwoods with light to med brush understory at the upper end of the project with grass predominate at the lower end.
1st day anchor fire in and proceed down the two flanks
2nd day, it MAY be necessary to Arial fire the interior with SIDS
3rd day, continue firing the dozer lines at the southern boundary.

☐ **Conditions:**
Observed weather conditions: Wind Direction South, Southwest
Air Temp. 55-60
R.H. 50-70

☐ **Sequence of Firing**:

1. Ignition will begin at anchor point(s)
2. Group A. @ north dozer line anchored into black
3. Group B @ Dozer line at Molina Ranch Farm Rd.
4. Day 2/3;Both groups working down their dozer lines anchored where they stopped working the previous day and meet on the southern dozer line
5.

Lockheed Firing Plan Page 2 of 3.

INCIDENT FIRING PLAN EXAMPLE - Page 3
Lockheed Incident

☐ **Aerial Ignition Plan (Section 8344.5 of the CAL FIRE 8300 manual):**

1. Ignition will begin at anchor point(s)
2. Using PSD Balls working from the upper elevations down to the start of the grass line. If the PSD are ineffective, the heli-torch we be
3. utilized
4.
5.

<u>Pre-Firing Checklist</u>

☐ All personnel briefed
☐ Weather forecast reviewed
☐ Resources in place
☐ Lookouts posted

☐ Communications systems in place
☐ Escape routes and safety zones established and made known
☐ Fire behavior forecast reviewed
☐ Test Fire is favorable

<u>APPROVALS and Initials</u>

☐ **Firing Group Supervisor Bill Weiser**
☐ **Division Supervisor <<**<u>name</u>**>>**
☐ **Branch Director Ian Larkin**
☐ **Air Operations Branch Director David Lopez**
☐ **Operations Chief Bob Toups/Cam Todd**
☐ **Safety Officer Barry Parker**
☐ **Incident Commander Rick Hutchison**

Prepared by: Bill Weiser/Larry Ochoa

Agency/Unit: CAL FIRE **Date: 8/16/09**

Lockheed Firing Plan Page 3 of 3.

IMMEDIATE NEED FIRING OPERATION CHECKLIST
Go/No Go Checklist

Immediate Need Firing Operation Checklist

GO / NO GO CHECKLIST

- ☐ All personnel briefed
- ☐ Weather forecast reviewed
- ☐ Resources in place
- ☐ Lookouts posted as needed
- ☐ Anchor and termination firing points identified
- ☐ Communications systems in place
- ☐ Fire behavior forecast reviewed
- ☐ Escape routes and safety zones established and made known
- ☐ Adjoining forces/Air Attack notified
- ☐ APPROVAL / NOTIFICATION(S) PRIOR TO FIRING

0044.4.1 V2

Immediate Need Firing Operation front.

Personnel Briefing

- Objectives
- Conditions
  - Weather
  - Fuel
  - Burn window
- Resource assignments
  - Firing personnel
  - Holding forces
  - Lookouts
- Ignition plan/sequence
- Communication Plan
- Contingency Plan
- Safety issues
  - Escape routes and safety zones

Immediate Need Firing Operation back.

FIRESCOPE PRIVATE RESOURCE UTILIZATION GUIDELINES
http://www.firescope.org/reference-materials/wildland/FIRESCOPE-private-resource-utilization-guide.pdf

FIRESCOPE

FIRE AND RESCUE SERVICE ADVISORY COMMITTEE/ FIRESCOPE BOARD OF DIRECTORS

3650 Schriever Avenue
Mather, CA 95655

To the California Fire Service:

The FIRESCOPE Board of Directors approved this document at its July 9, 2008 meeting. This document is intended to provide guidelines when encountering private fire resources, utility companies, etc. on incidents.

Recently, private fire resources have been on the Juliet and Sesnon fires. The caliper of these resources varies depending upon the insurance company that contracts with the private vendor. This ranges from a vendor that reports to the ICP, has fire qualified staff, attends briefings, has compatible radios and complies with all road closures and motor vehicle rules to the "wildcat" vendors that do the opposite.

These guidelines are intended to provide general direction for command staff. FIRESCOPE supports the use of private vendors to perform pre-suppression fuels treatment and steps to protect structures prior to the fire's arrival, but they should not work within an area under evacuation orders.

Private Resource Utilization Guidelines

Issue

The issue before the fire service today is how to address the command, control, liability and safety issues associated with private resources.

Discussion

Private resources (contractors) may be allowed to operate on an emergency incident (within a restricted area) only if they are under contract to the AHJ or cooperating fire agency. Private fire brigades may also be integrated within the incident if they have legal authority and jurisdiction to operate, are fully qualified and have a working relationship with neighboring fire agencies. These private resources are held to the same operational and training standards as public fire agencies. Initial legal review indicates that the AHJ/IC has the authority to restrict resources that may enter a closed area. Private property owners have the legal right to protect their property if they are on-site during the emergency incident, but once evacuated are not allowed re-entry during said incident when a mandatory evacuation order is in place.

All other private resources utilized should be restricted to non-emergency activities outside of the evacuated or restricted area to ensure safety, command, control and minimize potential liability issues. Private resources may include utility companies, contractors or laborers providing defensible space/ fire protection, etc. These resources have a role before, during and after the emergency incident, but only within areas deemed safe and have the expressed authorization of the AHJ/IC. If they are given evacuation orders, they must comply.

FIRESCOPE Resource Utilization Guidelines page 1.

FIRESCOPE PRIVATE RESOURCE UTILIZATION GUIDELINES
http://www.firescope.org/reference-materials/wildland/FIRESCOPE-private-resource-utilization-guide.pdf

The fire service needs to work with the insurance companies to safely utilize private fire protection resources. As the nation is witnessing, there are more fires and threatened structures today than public and private fire protection forces can respond to. Most of these services advertise that they will respond if a fire is within three miles of the insured property. With that said, it seems that the paramount marketing tool for the insurance companies should be that they endorse property owners adhering to FIREWISE or similar prevention/protection standards yearlong. A homeowner will be better off using private resources to create defensible space, retrofit structures to a modern wildland building code and installing fire suppression systems (internal & external) so the structure can survive a wildland fire even if a fire protection services cannot arrive prior to the fire. This is particularly important, as most structures are lost in the initial attack phase of wildland fires.

Command, Control, Liability, & Safety

The emerging private fire protection industry is not regulated and does not have any local, State, Federal, National standards, or enabling legal authority to follow while employing staff or responding to incidents. Many follow NWCG guidelines, employ off-duty/retired or experienced firefighters, but the AHJ/IC may not know their true ability/capability. Some vendors have already appeared unannounced on fires, violating road closures while trying to sell their services to homeowners during a developing crisis.

The AHJ/IC must be able to account for all resources under his/her command, especially when evacuation orders are given. The AHJ/IC is responsible and now proven to be liable for unsafe acts. Therefore, allowing additional resources within a closed hazard area without compatible communications, standardized training, certifications and qualifications, and so forth can compromise safety as well as obstruct ingress/egress of firefighters and public.

Background

Over the past few years, insurance companies have seen an increase in their insured property losses due to wildfires. This development has spawned a resurgence of interests from private vendors and the insurance industry to offer what they claim to be an augmentation of traditional public fire protection services. Further evaluations also indicate that the coordination of utility company resources and other private vendors is not well addressed on emergency incidents.

In order to insure the protection of the public, first responders and the private resource operators themselves, it is incumbent on the fire service (local, state & federal) today to clarify the potential impact of these operations and clearly establish command, control, liability and safety parameters under which private resources can operate on incidents.

Appendix A
Private Resource Guidelines

The following guidelines serve as a tool for the AHJ/IC in managing private resources on incidents:

1. All private resources must respect the decision of the AHJ/IC as they're the final decision makers in the command, control, liability and safety of the incident.
2. The AHJ/IC and law enforcement has complete authority and legal right to control an emergency incident. Private resources are <u>not</u> first responders and are

FIRESCOPE Resource Utilization Guidelines page 2.

FIRESCOPE PRIVATE RESOURCE UTILIZATION GUIDELINES
http://www.firescope.org/reference-materials/wildland/FIRESCOPE-private-resource-utilization-guide.pdf

completely subject to the directions and limits set forth by public safety agency personnel. The private resource has no claim or stake in unified command and will not have any role in incident command.

3. Private resource vendors shall provide a representative that reports to the Incident Commander or the Liaison Officer and can communicate with their resources.
    a. This representative shall attend all planning and operational briefings and should be available to represent said entity in regards to qualifications and specific interests to be involved, etc.
    b. Private resources are responsible to communicate their location and movements through the private resource representative to the Incident Commander/Liaison Officer.
    c. Failure to notify the Incident Commander/Liaison Officer of the location or movement of private resources could subject them to removal from the incident.
4. Private resources shall check-in with the Incident Commander prior to deployment within an emergency area. ICs need to maintain situational awareness regarding private resources and their compliance with evacuation orders.
5. A message should be included in the incident action plan and briefed at operational briefings regarding known private resources activity on or near the incident.
6. Private resources must be able to monitor incident radio traffic so they maintain situational awareness and know when an area is being evacuated/ restricted. They shall refrain from using incident radio frequencies.
7. Private resources should focus their activities on pre-fire activities and pretreatment of values-at-risk prior to a road closure order.
    a. Once a road closure is ordered, they must evacuate the area so safety is not compromised and cannot return until the area is reopened, or until they have received IC authorization to re-enter.
    b. If the private resource does not evacuate the area, the private resource assumes full responsibility for the safety of the resource, personnel and equipment.
    c. The AHJ/IC should not be held liable for any loss, injury or death.
8. The IC or local law enforcement officials having jurisdiction must authorize access to any community under evacuation/restriction.
9. Private fire protection resource contractors who are employed on an incident (as a local, State or Federal resource) are not allowed to sub contract with the insurance industry or freelance to local home owners while mobilized on the incident.
10. Private resources not under contract to a public fire agency shall adhere to all local business license provisions.
11. All private fire protection resources should be identified (non-emergency) on the outside of the vehicle, to ensure they do <u>not</u> appear to be a public fire resource. This includes no red lights, sirens or facsimile fire agency decal.
12. During fires where a community meeting is hosted by the AHJ/IC, a clear understanding must be created with the general public as to the role of government in incident command and private resources.

FIRESCOPE Resource Utilization Guidelines page 3.

CAL FIRE DIRECT SUPERVISION POLICY
CAL FIRE Emergency Incident Management Handbook, 7700
http://calfireweb.fire.ca.gov/library/handbooks/7700/7761.pdf

COORDINATION AND SUPERVISION 7761.1

(No. 39 July 2011)

Go to Hiring and Utilization Index

DIRECT SUPERVISION 7761.1.1

(No. 39 July 2011)

All incident commanders must provide direct supervision for all hired resources. Division and Group supervisors are responsible for the safety, proper deployment, and time keeping of their assigned resources. They will prepare shift tickets and contractor evaluations for all hired equipment resources assigned to their supervision.

When forming a functional group, strike team, or task force containing hired equipment, the functional Group Supervisor or Strike Team/Task Force Leader shall perform the following duties:

1. Determine equipment readiness and conformance to requirement standards.
2. Respond to the incident with the group or task force.
3. Act as group supervisor or task force leader under direction of Operations Section personnel.
4. Initiate shift ticket process.
5. Prepare contractor evaluations

The ratio of supervisors to resources should be as follows:

Dozer Strike Team:	2 dozers, 1 dozer tender	1 Strike Team Leader
Water Tender Strike Team:	5 tenders	1 Strike Team Leader
Task Force or Functional Group:	1-5 resources	1 Leader/Supervisor
	5-10 resources	2 Leaders/Supervisors 1 Tech. Spec. <u>or</u> Hired Equipment Coordinator
	10-15 resources:	2 Leaders/Supervisors 1 Tech. Spec. <u>and</u> a Hired Equipment Coordinator

<u>Bulldozer:</u> Privately owned bulldozers under agreement to CAL FIRE shall have a fully trained and qualified fire line supervisor available in the immediate area who is assigned to direct the private bulldozer operator at all times during any suppression activities. These private operators **will not** work on the fire line without such supervision.

<u>Water Tenders:</u> Privately owned water tenders under agreement with CAL FIRE shall not be engaged in direct fire suppression efforts on any active fire line (line where the fire could continue to spread, flare-up, or spot over the line). Water tenders assigned to support firefighting activities shall be positioned in areas that provide an immediate safe exit route. Safe placement of these vehicles shall be the responsibility of the Fire Line Supervisor under whose supervision the water tender was placed. Water tender operators must insure that their radio is operating properly in order to maintain communications with their fire line supervisor.

CAL FIRE Direct Supervision Policy.

IMMEDIATE NEED EVACUATION GUIDELINES

Immediate Need Evacuation Guidelines

This checklist will assist Law Enforcement and Fire Department personnel in the implementation of an Immediate Evacuation Area. It is designed to provide coordination and improve effectiveness in the initial attack phase of an incident.

Immediate Need Evacuation Guidelines

- ☐ Identify the need for an immediate evacuation area.
- ☐ Determine potential for incident spread and request appropriate resources to complete evacuation and mitigate incident concurrently. (Include Law Enforcement AHJ)
- ☐ Establish an Incident Command Post (ICP); co-locate law enforcement at ICP.
- ☐ Identify evacuation area utilizing Thomas Brothers Map or other appropriate map reference (provide map page reference and grid.) Include area of incident potential when determining evacuation area.
- ☐ Identify traffic control points for entry and exit of resources and civilians.
- ☐ Identify areas that must be immediately evacuated and label “evacuation order” areas.
- ☐ Identify areas that are potentially threatened and label “evacuation warning” area.
- ☐ Identify “safe refuge” areas inside evacuation areas.
- ☐ Determine and publish evacuation routes.
- ☐ Divide incident into appropriate divisions of labor and develop incident organization.

CONSIDERATIONS – *(as time allows)*

- ☐ Requesting Liaison function for Public Notification Systems. (Local OES)
  - *Emergency Alert System
  - *Commercial phone/paging/email notification systems (Reverse 911)
  - *Warning Sirens
- ☐ Identify and clearly communicate the Decision Points for implementing additional evacuation areas. Evaluate the evacuation and expand or contract the plan as necessary.
- ☐ Identify areas of Special Needs Population and large animals.

CAL FIRE Immediate Need Evacuation Guidelines.

EVACUATION AND REPOPULATION PLAN

From CAL FIRE Intranet : http://calfireweb.fire.ca.gov/organization/fireprotection/imt/

EVACUATION AND REPOPULATION PLAN

Rev 2 (05/13)

EVACUATION AND REPOPULATION PLAN

This packet will assist emergency response personnel in the implementation of an evacuation and repopulation plan.

Evacuation Plan Instructions (Blocks 1-12):

Block 1. Fill in the incident name, incident number, name of preparer, and date and time prepared.

Block 2. Fill in affected area(s). Be specific and include community names, streets, or map page grids. Include type of protective action for each area: (Immediate) Evacuation Order, Evacuation Warning, Closures, Shelter in Place, use of Safe Refuge Areas, use of Community Safe Refuge Areas, use of Survival Areas. Use each numbered line for a separate area. See 'Definitions' for assistance.

Block 3. List decision points to initiate protective actions for each area noted above. Each numbered line corresponds with a numbered affected area listed above.

Block 4. Enter the predicted time that the incident, situation, hazard, or fire will take once it arrives at a decision point, and until it reaches an affected area.

Block 5. Obtain Incident Commander's signature, agency identifier, and date of signature.

Block 6. Obtain signature of law enforcement or Operations Section personnel in charge of implementing the plan.

Note: The first page of the plan can be used to document an immediate need evacuation. As time allows, continue filling out the following pages for planned evacuations.

Block 7. List traffic control points that agencies will use to block or limit access to the incident or area. The locations of traffic control points (TCPs) are usually determined by law enforcement. List the level of closure associated with each traffic control point. The level of closure is generally determined by the Incident Commander with input from the Operations Section and Safety Officer. The level of closure may be adjusted within minutes depending on the incident's activity. A information sheet on the TCP with level of closure should be provided to staff manning the TCP. A map should be made identifying traffic control points and evacuation areas.

Block 8. List the methods that the law enforcement agency having jurisdiction will use to notify the public of protective actions being implemented in an area.

Block 9. List evacuation routes for the public to exit an affected area. Evacuation routes should be added to an incident travel map if possible.

Block 10. List travel routes for emergency responders into the incident or evacuation area. Travel routes to be used by emergency vehicles should be added to an incident travel map if possible.

Block 11. List public shelters open for the incident. Provide an address for the shelter and contact information that can be provided to the media, elected officials, and the public.

Block 12. List animal shelters for large animals and household pets. Provide an address for the shelter and contact information that can be provided to the media, elected officials, and the public.

Note: This is the last step of the Evacuation Plan. The Repopulation Plan begins below.

EVACUATION AND REPOPULATION PLAN

Repopulation Plan Instructions Blocks 13-17):

Block 13. Fill in the incident name, incident number, and the date/time the plan should be initiated. This is the first step of the Incident Repopulation Plan.

Block 14. List areas that are being affected by the Repopulation Plan. For each area, list any closures that will remain in effect once the area is repopulated.

Block 15. Place a check by each safety issue once the item has been mitigated or cleared by the authorizing individual as well as the date and time it was authorized.

Block 16. Distribute the plan as detailed. Place a check for each position as the plan is distributed.

Block 17. Add the name of the preparer and have the Incident Commander date and sign the plan.

Repopulation criteria shall take into account emergency worker safety and the community needs.
Control of repopulation to an evacuated area shall be accomplished during planning meetings with command and general staff, and coordinated with media releases and incident action plan instructions. Local residents may be allowed to repopulate with escorts or while mop-up operations and infrastructure repair continue if the situation allows.
Coordination with assisting and cooperating agencies is critical to the success of repopulation planning. Ultimately it is a law enforcement decision based on fire department input to approve repopulation of citizens back into an area previously closed or evacuated.

Definitions

Evacuation Order-Movement of community members out of a defined area due to an immediate threat to life and property from an emergency incident. An Evacuation Order should be used when there is potential or actual threat to civilian life within 1 to 2 hours or when the IC deems it necessary to protect civilians.

Evacuation Warning-Alerting of community members in a defined area of a potential threat to life and property from an emergency incident. An Evacuation Warning may be issued when the potential or actual threat to civilian life is more than 2 hours away.

Levels of Closure-A closure prohibits the usage or occupancy of a defined area such as a park, beach, or road due to a potential or actual threat to public health and/or safety. Media is allowed under all closure levels unless prohibited under PC 409.5

Level 1 Closure / Color Code Green- Closed to all traffic except local residents; may require escorts.

Level 2 Closure / Color Code Yellow - Closed to all traffic except FD, LE, and critical incident resources (i.e. utility companies, Caltrans, County Roads, etc.).

Level 3 Closure / Color Code Orange - Closed to all traffic except FD and LE.

Level 4 Closure / Color Code Red -Closed to all traffic including FD and LE.

Shelter in Place-Directing community members to stay secured inside their current location. Used if evacuation will cause higher potential of loss of life.

Safe Refuge Area-A temporary location to hold evacuees until safe evacuation is possible.

Rescue- Emergency actions taken within the affected area to recover and remove injured or trapped citizens. Boundaries of the areas where rescue is planned should be identified on the incident map with notation that entry is restricted to rescue workers only.

EVACUATION AND REPOPULATION PLAN

EVACUATION PLAN (Blocks 1-12)				
Block 1	**Incident Name:**		**Incident #:**	
Prepared by:		**Date:**	**Time:**	
Block 2	**Affected Area(s) & Type** ***Evacuation Order, Warning, Shelter in Place, Closure, Safe Refuge Area***			
1.				
2.				
3.				
4.				
5.				
Block 3	**Decision Points to Initiate Above Actions**		**Block 4**	**Predicted Time to Reach Affected Area**
1.			Hour(s)	
2.			Hour(s)	
3.			Hour(s)	
4.			Hour(s)	
5.			Hour(s)	
Block 5	**Incident Commander(s)**			
Name & Signature Agency:			Date:	
Name & Signature Agency:			Date:	
Name & Signature Agency:			Date:	
Name & Signature Agency:			Date:	
Block 6	**Law Enforcement or Operations Sec. Chief**			
Name & Signature Agency:			Date:	

EVACUATION AND REPOPULATION PLAN

Block 7	Traffic Control Points	Levels of Closure for Area
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Closure Levels:

Level 1 / Color Code Green: Closed to all traffic except local residents; may require escorts.
Level 2 / Color Code Yellow: Closed to all traffic except FD, LE, and other critical incident resources (i.e. utility companies, Caltrans, County Roads etc.)
Level 3 / Color Code Orange: Closed to all traffic except FD and LE
Level 4 / Color Code Red: Closed to all traffic including FD and LE

- *Traffic control points must cover all sides of the incident and should be located outside the Evacuation Warning area. Traffic control points should be identified as TCP on the incident maps and closure levels identified for each point. (Example: TCP 4 refers to Traffic Control Point- Level 4 closure). Points should also be displayed on evacuation maps.*
- *Provide a Traffic Control Info Sheet to TCP staff if possible.*
- *Media is allowed access under all closure levels unless prohibited by Penal Code Section 409.5*

Block 8	Process for Initial Notification of Public & Time Initiated *(Phone, EAS, Sirens, Door-to-Door) By Who, Date and Time Initiated*
1.	
2.	
3.	
4.	

Block 9	Evacuation Routes for Public (Exiting area)

EVACUATION AND REPOPULATION PLAN

1.	
2.	
3.	
4.	
5.	
6.	
Block 10	**Travel Routes for Emergency Responders** **(Entering Area)**
1.	
2.	
3.	
4.	
5.	
6.	
Routes shall be coordinated with IC, Ops & Logs Sec. Chiefs. Routes for Evacuation Order areas should be determined first. *Display evacuation routes on incident maps and ensure EOC(s) are informed if activated.* *Consider transportation and barricade needs early.*	
Block 11	**Public Shelters or Safe Points** **Name, Address, and Contact Information**
1.	
2.	
3.	
4.	
5.	
ICP (or EOC as applicable) should identify approximate number of evacuees, anticipated duration of incident, and direction emergency may head, to assist Red Cross in choosing a safe shelter location. *Public shelters should be staffed with Incident Information Officers.* *Display public shelters on incident maps with a red cross.*	

EVACUATION AND REPOPULATION PLAN

Block 12	**Large Animal/Pet Shelters-** Name, Address, and Contact Information
1.	
2.	
3.	
4.	

Animal/pet shelter locations must be coordinated between LE and Animal Control.

ICP or (EOC as applicable) should identify approximate number/type of pets and anticipated duration of incident.

Definitions

Evacuation Order-Movement of community members out of a defined area due to an immediate threat to life and property from an emergency incident. An Evacuation Order should be used when there is potential or actual threat to civilian life within 1 to 2 hours or when the IC deems it necessary to protect civilians.

Evacuation Warning-Alerting of community members in a defined area of a potential threat to life and property from an emergency incident. An Evacuation Warning may be issued when the potential or actual threat to civilian life is more than 2 hours away.

Levels of Closure-A closure prohibits the usage or occupancy of a defined area such as a park, beach, or road due to a potential or actual threat to public health and/or safety. Media is allowed under all closure levels unless prohibited under PC 409.5

Level 1 Closure / Color Code Green- Closed to all traffic except local residents; may require escorts.

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EVACUATION AND REPOPULATION PLAN

REPOPULATION PLAN (Blocks 13-17)			
Block 13	**Incident Name:**	**Incident #:**	
Date to be initiated:		**Time to be initiated:**	
Block 14	**Repopulation Area(s)**	**Level of Closure** (No closure, or 1-4)	
1.			
2.			
3.			
4.			
Block 15	**Repopulation Checklist**	**Authorizing Name-Date-Time**	
☐	Fire or emergency threat mitigated		
☐	Utilities secured ☐ Gas ☐ Electric ☐ Telephone ☐ Water		
☐	Infrastructure hazards mitigated (roads, bridges, etc) ☐ Public Works ☐ Caltrans		
☐	Law Enforcement approval ☐ Sheriff ☐ Local PD ☐ CHP		
☐	Other		
☐	Other		
☐	Incident Commander Approval		
☐	Fire Agencies notified ☐ CAL FIRE ☐ USFS ☐ Fire District/Department		
☐	American Red Cross Notified		
☐	Emergency Operations Center(s) notified		
☐	Incident Information Officer notified		
☐	Incident Liaison Officer notified		
☐	ICS 209 updated		

EVACUATION AND REPOPULATION PLAN

Evacuation and Repopulation Plan Rev. 05/13

Block 16	Evacuation Plan Distribution
☐ Incident Commander(s)	☐ Operations Section Chief(s)
☐ Planning Section Chief	☐ Logistics Section Chief
☐ Finance Section Chief	☐ Public Information Officer
☐ Liaison Officer	☐ Incident Safety Officer
☐ Law Enforcement	☐ Public Officials (Mayor/City Manager)
☐ Caltrans/Local Streets Dept	☐ Emergency Operations Center(s)
☐ County OES	☐ CAL EMA
☐ California Highway Patrol	☐

Block 17	Prepared by:	Date:
Incident Commander:		Time:
Incident Commander:		Time:

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STRUCTURE DEFENSE PLAN TEMPLATE

STRUCTURE DEFENSE PLAN TEMPLATE

block		
1	**Name**	**(Name of Planning Area)**
2	**Activation Authority**	Incident Commander, Operations Chief, Branch, XXXXX
3	**Level of Organization**	Branch, Division, Group or Other (include name)
4	**Objectives of Structure Defense Plan**	Provide for Emergency Worker Safety
		Safely evacuate citizens
		Provide for evacuation of animals
		Protect assets at risk (target hazards, communication sites, powerlines, railroads, freeways, etc.
		Defend structures in the XXXX community
		and / or
		Defend structures **North of**
		Defend structures **West of**
		Defend structures **South of**
		Defend structures **East of**
5	**Decision Points for Activation of Plan**	Activate contingency or Action when fire hits XXXXX Decision Points and the estimated time of arrival after the fire reaches a decision point to the area being planned for.
6	**Contingency Narrative**	Provide short narrative regarding the goal and objective of this plan.
7	**Resources Suggested**	
	Engines – Type 3	Single, Task Force or Strike Team
	Engines – Type 1/2	Single, Task Force or Strike Team
	Handcrews	Single, Task Force or Strike Team
	Dozers	Single, Task Force or Strike Team
	Airtankers	Type
	Helicopters	Type
	Watertenders	Type
	Specialized Resources	Firing Tools, CAFFS, Gels, etc.
	Overhead	XX OPBD, XX DIVS, XX GRPS, XX SOFR, XX FOBS XX STAM
8	**Acreage**	Estimated total acreage of contingency.
9	**Infrastructure Threatened**	Estimated number of structures, powerlines, communication sites, etc. for the planned area.
10	**Water Supply**	Identify water supplies for engines, water tenders and helicopters.
11	**Special Hazards**	Identify hazards specific to the area being planned for. Hazards identified my include narrow roads, mine shafts, hazardous storage facilities, water delivery problems, extreme fire history in are and clandestine labs for example.

November 4, 2013 1

Structure Defense Plan template page 1.

STRUCTURE DEFENSE PLAN TEMPLATE

STRUCTURE DEFENSE PLAN TEMPLATE

1	Name	(Name of Planning Area)
12	Staging areas, drop points & ICS facilities	Identify potential staging areas, drop points, etc. that may be used for the area. Provide addresses, Lat/Long, phone numbers of owners and other useful information. Include safety zones and public safe refuge areas as well.
13	Evacuation Order Areas	Insert Thomas Bros. info: community names, street names, etc.
14	Evacuation Warning areas	Insert Thomas Bros. info: community names, street names, etc.
15	Traffic Control Points Type and Location	Detail where traffic control points should be located and what level of closure they will be. Use address, street and cross street, or Lat/Long.
16	Communication Frequencies	List Command frequencies and tones, Tactical frequencies to be used if Plan is implemented.
17	Contacts	List contact information for possible cooperators should the plan be implemented. Examples of cooperators include EOCs, law enforcement AHJ, animal evacuation groups, utility companies, Native American tribes, etc.
18	Prepared by: ICS Title: Date:	
	Approved by: ICS Title: Date:	

November 4, 2013 2

Structure Defense Plan template page 2.

STRUCTURE DEFENSE PLAN INSTRUCTIONS

Structure Defense Planning Template Instructions

1. In Block 1, insert the name of the plan that is being prepared for. Example, Paradise Structure Defense Plan or Camino Cielo Ridge Structure Defense Plan.
2. In Block 2, name the incident ICS title and person(s) responsible to make the decision to activate the Structure Defense Plan.
3. In Block 3, describe the type of ICS structure that that is being planned for. Example includes implementing the plan with division supervisors, group supervisors, and branch directors.
4. In Block 4, write the objectives of the Structure Defense Plan. Some objectives will always be included, such as "Provide for emergency worker Safety" and evacuation of civilians and animals. The objective should also clearly describe the area to be defended by naming the community or geographically such as "Protect structures north of" etc…
5. In Block 5, list the Decision Points for the planning area. The decision point should be far enough away from the planning area to allow enough reflex time to implement the plan. Estimate and include the time the fire will take to reach the planned area after crossing the decision point.
6. In Block 6, provide a short narrative detailing the plan and the area involved.
7. In Block 7, list various resources and overhead that may be needed to make the plan successful. Remember, that these resources may be obtained from the incident and not require new orders. These resources may also be used for perimeter control if needed by the Operations section.
8. In Block 8, add the acreage of the area being planned for. Estimate if needed.
9. In Block 9, include the number of structures in the area, power lines and other critical infrastructure, and any historical landmarks that need to be protected. Use APN maps if possible to provide an accurate number of both potential dollar loss and threatened structures.
10. In Block 10, identify water supplies that can be used by suppression forces and helicopters. Provide address, lat/long and contact information of landowners if possible.
11. In Block 11, provide a hazard assessment of the planned area and any abatements or mitigations that can be done to increase the safety of emergency workers.
12. In Block 12, identify incident facilities that may be set up to support the actions within the planning area, including staging areas, Division/Group and Branch boundaries, drop points, spike camps, perimeter control points, dozer unload points, safety zones and public safe refuge areas etc… Provide address, lat/long, and contact information of landowners if possible.
13. In Block 13, include the name and geographic description of any areas under an Evacuation Order in or around the planning area. If there are no Evacuation Orders, than make recommendations should the Structure Defense Plan be implemented.
14. In Block 14, include the name and geographic description of any areas under an Evacuation Warning in or around the planning area. If there are no Evacuation

Page 1 of 2

Structure Defense Plan instructions page 1.

STRUCTURE DEFENSE PLAN INSTRUCTIONS

Warnings, than make recommendations should the Structure Defense Plan be implemented.

15. In Block 15, list Traffic Control Points associated with current Evacuation Orders in the area. If there are no Traffic Control Points, make recommendations for locations and level of closure should the area planned for require an Evacuation Order.
16. In Block 16, list frequencies and repeater tones that can be used in the planned area should the plan be implanted. Include enough tactical frequencies for ground resources and indicate which command net repeater tones can be used. List Logistical nets and air to ground nets if needed.
17. In Block 17, provide contact information for cooperators that will be affected if the Structure Defense Plan is implemented. Cooperators could include; adjoining fire departments and law enforcement agencies, emergency operations centers, animal evacuation groups, home owner associations, water districts, utilities companies, Native American Tribes, etc…
18. In Block18, include name of preparer, ICS title and date prepared. Finally, obtain the signature, ICS title of the approver of the Structure Defense Plan as well as the date approved.

Structure Defense Plan instructions page 2.

STRUCTURE DEFENSE PLAN TEMPLATE

block		
1	**Name**	
2	**Activation Authority**	
3	**Level of Organization**	
4	**Objectives of Structure Defense Plan**	
5	**Decision Points for Activation of Plan**	
6	**Contingency Narrative**	
7	**Resources Suggested**	
	Engines – Type 3	
	Engines – Type 1/2	
	Handcrews	
	Dozers	
	Airtankers	
	Helicopters	
	Watertenders	
	Specialized Resources	
	Overhead	
8	**Acreage**	
9	**Infrastructure Threatened**	
10	**Water Supply**	

STRUCTURE DEFENSE PLAN TEMPLATE

1	**Name**			
11	**Special Hazards**			
12	**Staging areas, drop points & ICS facilities**			
13	**Evacuation Order Areas**			
14	**Evacuation Warning areas**			
15	**Traffic Control Points Type and Location**			
16	**Communication Frequencies**			
17	**Contacts**			
18	Prepared by:		ICS Title:	Date:
	Approved by:		ICS Title:	Date:

STRUCTURE DEFENSE GUIDE

STRUCTURE DEFENSE GUIDE

STRUCTURE TRIAGE DECISION PROCESS (S-FACTS)

SURVIVAL

- Initial Assessment: can you survive here? **If not, LEAVE NOW!**
- Is there a Safety Zone nearby? **If not, LEAVE NOW!** *(IRPG)*
- Do you have a viable Escape Route?
- What is the decision point at which you will leave based on fire behavior and rate of spread?
- Is there a Temporary Refuge Area (TRA) on site? **If not, LEAVE NOW!**
  - Preplanned area for immediate, temporary refuge
    - Use of fire shelter should not be necessary
  - Is there a viable Escape Route to the TRA or Safety Zone?
- Is "Prep and Go" tactic an option?
- Do you have communications with your supervisor and adjoining forces?
- If safety issues cannot be mitigated, **LEAVE NOW!**

FIRE ENVIRONMENT

- Can you survive based on current and expected fire behavior? **If not, LEAVE NOW!**
- Look up, Look Down, Look Around Indicators:
  - Fuels (characteristics, moisture, temperature)
    - What will the intensity of the fire be when it arrives?
    - How long will it take to consume the fuels?
  - Wind
    - Current speed/direction
    - Expect changing winds
  - Terrain
    - Are you in a chute, chimney, or saddle? **If yes, LEAVE NOW!**
    - Is wind in alignment with topography?
    - What is your position relative to topography?
    - Are you mid slope or on top of a ridge?
  - Atmospheric Stability
  - Fire Behavior (requires constant monitoring)
    - Spotting, crowning, sheeting, rate of spread?
    - Flame length and height?
- Other weather considerations:
  - What is the current relative humidity?
    - Is there an expected change?
  - Are thunderstorms forecasted?

ACCESS

- Is access compatible with time and distance factors necessary to utilize as an Escape Route to a Safety Zone?
  - Road surface adequate for speed necessary?
  - Adequate width?
  - Turnaround/turnouts?
  - Bridges within limits for fire apparatus?
  - Drainage ditches/culverts?
  - Steep grades?
  - Is there a safe place to spot apparatus?

CAL FIRE Structure Defense Guide (rev 4_11) front.

STRUCTURE DEFENSE GUIDE

CONSTRUCTION/CLEARANCE

- Does the structure have adequate defensible space, based on topography, fuels, and current and expected fire behavior?
- Can defensible space problems be mitigated quickly?
- Will building materials and yard clutter compromise safety?
- Is the construction wood siding or shake shingle roof?
- Are there vent openings, open eaves, large glass windows facing fire front, decks with vegetation below?
  - Will ember intrusion through attic or foundation vents be a problem?
- What are the contents in the garage and outbuildings?
- Are there hazardous materials present?
- Are there propane tanks, fuel tanks, or power lines?
- Is there an adequate water supply nearby?
- Are additional resources needed to mitigate issues?
- Consider "Prep and Go" or "Prep and Defend" tactics

TIME CONSTRAINTS

- Is there time for an adequate size up of the structure defense problem?
- Is there time to mitigate safety concerns?
- Is there time and adequate resources to properly prepare and defend the structure?
- Is there time to escape, utilizing Escape Routes, to a Safety Zone? **If not, LEAVE NOW!**

STAY OR GO

- Tactical decision based on the S-FACTS
- Is it safe to stay? If no, utilize "Check and Go" tactic
- Is there time to prepare the structure for defense and what will the fire behavior be when the fire gets here?
- "Prep and Go" or "Fire Front Following" tactics should be used when it is not safe to "Prep and Defend"

STRUCTURE TRIAGE CATEGORIES

Not-Threatened

- Safety Zone nearby and TRA present at structure
- Construction features/defensible space make the structure unlikely to ignite
- Residents may/may not have evacuated

Threatened Defensible

- Safety Zone nearby and TRA present at structure
- Construction features/defensible space require structure defense tactics during fire front impact
- Residents may/may not have evacuated

Threatened non-Defensible

- Lack of adequate Safety Zone nearby
- Structure cannot be safely defended
- Residents must be evacuated

ENTRAPMENT AVOIDANCE

- Are you adhering to the **10 Standard Firefighting Orders**? *(IRPG)*
- Have you considered the **18 Situations that Shout Watch Out**?
- Have you considered the **Common Denominators of Fire Behavior on Tragedy Fires**? *(IRPG)*
- Are you maintaining **LCES**? *(IRPG)*
- Look Up, Look Down, Look Around *(IRPG)*
- Have Decision Points ("Trigger Points") been established?
- Conduct Risk Management *(IRPG)*
  - Situational Awareness – Hazard Assessment – Hazard Control – Decision Point – Evaluate

CAL FIRE Structure Defense Guide (rev 4_11) inside right.

STRUCTURE DEFENSE GUIDE

STRUCTURE DEFENSE TACTICAL ACTIONS

- **Check & Go** – Most appropriate action when no Safety Zone/TRA is present and fire front impact is imminent. Conduct rapid evaluation to check for occupants and evaluate for follow up action. **LEAVE promptly.**
- **Prep & Go** – Structure preparation can be safely completed prior to fire front impact. Potential fire activity is too dangerous to remain and/or there is no Safety Zone/TRA present. **LEAVE before escape routes are compromised**.
- **Prep & Defend** – Appropriate when a Safety Zone is nearby and TRA is present. Adequate time exists to prepare the structure for defense prior to fire front impact. Escape routes must be maintained.
- **Fire Front Following** – Follow-up tactic after passage of the fire front. Involves searching for victims, perimeter control, hot spotting, and ember control.
- **Bump & Run** – Resources move ahead of the fire front extinguishing spot fires and defending structures. Utilize extreme caution.
- **Anchor & Hold** – Resources use large volume fire streams to extinguish structure fires, stop structure-to-structure ignitions, protect exposures, and control embers.
- **Tactical Patrol** – Resources remain mobile and continuously monitor assigned area after fire front passage. Involves aggressive mop up around structures.

Structure defense tactics are a vital part of perimeter control operations.

- ***Stopping fire spread significantly eliminates the fire's threat to structures.***
- ***Connect contained points along the fire's perimeter – typically near the structures at risk ("Connect the Dots").***
- ***Perimeter control and structure defense should be done concurrently.***

LEVELS OF ENGAGEMENT

Consider PACE

- **P**rimary Plan (Offense)
  - Focused on firefighter safety and objectives
- **A**lternate Plan (Offense)
  - Fallback plan that closely resembles primary plan
- **C**ontingency Plan (Defense)
  - Focused on firefighter safety, move to a safety zone, temporary refuge areas
- **E**mergency Plan (Defense)
  - Firefighter survival
    - Deployment zones/Refuge areas
    - Fire shelters

Consider DRAW-D

- **D**efend – **R**einforce – **A**dvance – **W**ithdraw – **D**elay

CAL FIRE Structure Defense Guide (rev 4_11) inside left.

STRUCTURE DEFENSE GUIDE

IMMEDIATE NEED EVACUATION CHECKLIST

- Co-locate with law enforcement at ICP
- Identify evacuation area utilizing local maps. Include area of incident potential when determining evacuation area.
- Identify traffic control points for entry and exit of resources and civilians
- Identify areas that must be immediately evacuated and label "evacuation order" areas
- Identify areas that are potentially threatened and label "evacuation warning" areas
- Identify community safe refuge areas inside evacuation areas
- Determine and publish evacuation routes
- Identify and clearly communicate the decision points for implementing additional evacuation areas
- Identify areas of special needs population and large animals
- Consider use of public notification systems for evacuations

STRUCTURE DEFENSE FUNDAMENTALS

- Back equipment in for tactical mobility
- Shield apparatus from radiant heat – be aware of structure ignition potential
- Park in a cleared area (watch for power lines, trees)
- Have an engine/crew protection line identified
- Determine if residents are home. Determine best course of action – evacuate if safe to do so or shelter in place at safe location
- Maintain communications with all crew members
- Maintain at least 100 gallons of water reserve in your tank
- Top off your tank at every opportunity (use garden hose)
- For roof access, place owner's ladder at a corner of the structure on the side with the least fire threat and away from power drop
- Keep fire out of heavier fuels (suppress in lighter fuels)
- Clear area around above-ground fuel tank, shutting off tank
- Close windows and doors, including garage, leaving doors unlocked
- Place combustible outside furniture inside the structure
- Charge and place garden hoses strategically around structure for immediate use
- Move wood piles away from structures
- Consider applying foam/gel to the structure (roof and siding) and/or fuels
- **REMEMBER** to follow up with **TACTICAL PATROL**!

CAL FIRE Structure Defense Guide (rev 4_11) back.

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C-234 Intermediate Firing, CAL FIRE
Incident Management 3 Power Point – CAL FIRE

<u>California Office of the State Fire Marshal</u>

Fire Command 1C, 2004

<u>FIRESCOPE</u>

S-334 Strike Team Leader Engine

<u>National Wildfire Coordinating Group</u>

S-215 Fire Operations in the Wildland/Urban Interface
S-290 Intermediate Fire Behavior
S-300 Extended Attack Incident Commander, version 1.0
S-300 Extended Attack Incident Commander
S-336 Tactical Decision Making In Wildland Fire
S-339 Division/Group Supervisor
S-400 Incident Commander
S-401 Safety Officer
S-430 Operations Section Chief

Green Sheets/Investigations

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Biography of Authors

WUI

Kelley Gouette started his fire service career in 1976 as seasonal firefighter with the Oregon Department of Forestry in Klamath Falls. He came to work for CAL FIRE in 1985 as a fire apparatus engineer in the Siskiyou Unit prior to transferring to San Bernardino. He spent ten years working in the Riverside and San Bernardino Units where his assignments included engine captain, training captain and helitack captain. He was the first helitack captain on Copter 305 assigned to the San Bernardino County Sheriff Aviation Unit. In 1994, Kelley promoted to battalion chief, Coves Battalion in Riverside. In 1997, Kelley transferred to the San Luis Obispo Unit where he worked the next ten years as field battalion chief, plains battalion, training/safety battalion chief and air attack battalion chief at the Paso Robles Air Attack Base. In 2007, Kelley transferred to the Shasta-Trinity Unit where he worked as the Redding Air Attack battalion chief and later that year promoted to assistant chief for operations in the Eastern Division. In 2009, he promoted to deputy chief/ operations in the Northern Region office. In 2010, he promoted to staff chief/operations in the Northern Region. Kelley spent 16 years on CAL FIRE and federal incident management teams as air operations and operations chief on CAL FIRE IMT #7 and as deputy IC on CAL FIIMT #6 and IMT #4. Kelley served as the chair of the CAL FIRE WUI Working Group.

Jerry Burke started his fire service career in 1967 as a firefighter I in the San Mateo-Santa Cruz Unit. He then worked for several years with the USFS serving on engines and hotshot crews on the Shasta-Trinity NF and Lassen NF. Jerry then worked for the NPS as a hotshot foreman and hotshot superintendent on the Bison Hotshots. In 1985, Jerry returned to CAL FIRE working as a FAE/ paramedic in the Fresno-Kings Unit. In 1987, Jerry transferred to the Shasta-Trinity Unit where he promoted to fire captain in 1989 at Crystal Creek Camp. In 1992, Jerry transferred to the Siskiyou Unit as a station and fire captain specialist in the Prevention Bureau. Jerry promoted to battalion chief in the Weott Battalion, Humboldt-Del Norte Unit. In 2003, Jerry transferred to the Lassen-Modoc Unit where he served as the Bieber and later as the Alturas battalion chief prior to his retirement in 2011. Jerry served for many years as the operations section chief on CAL FIRE IMT #2.

Phill Veneris started his fire service career in 1984 with the Vandenberg Hotshots and as a volunteer firefighter with the city of Arroyo Grande. He came to work for CAL FIRE in 1985 as a firefighter I in the San Luis Obispo Unit. In 1987, he promoted to FAE in the Tuolumne-Calaveras Unit before promoting to fire captain at Ventura Camp in 1992. From 1995-2001, he served as an engine captain and training/safety officer in San Luis Obispo prior to promoting to the North Coast Battalion Chief in 2001. Phill has served for 16 years on federal and CAL FIRE IMT's as a division supervisor, operations section chief, deputy incident commander and incident commander on CAL FIRE IMT's #7 and #8.

Vince Peña started his fire service career in 1981 as a firefighter/paramedic with Los Angeles County Fire Department. In 1988, Vince transferred to fire crew supervisor in the LA County Camp program. In 1990, Vince promoted to captain where he served as an engine captain, truck captain and training officer. In 2000, Vince advanced to field battalion chief in the Inglewood Battalion. In 2002, Vince transferred to camp battalion chief. In 2008, Vince transferred to field battalion chief in the San Dimas Battalion. In 2012, Vince promoted to assistant chief in charge of the Air and Wildland program. Vince serves as an operations section chief with the Los Angeles County IMT.

Mike Martin started his career in 1970 as a volunteer firefighter in the Fresno-Kings Unit. In 1972, Mike went to work as a firefighter I for CAL FIRE in the Tuolumne-Calaveras and Tehama-Glen Units. In 1979, Mike promoted to FAE in the Butte Unit. In 1984, Mike promoted to fire captain in San Mateo-Santa Cruz Unit and then worked as a fire captain specialist in the prevention bureau. Mike promoted to battalion chief in the Sunol Battalion in 1990 where he has spent the last 23 years. Mike has served for 20 years on CAL FIRE IMT's as a public information officer, operations chief and liaison officer.

Jeff Brand started his career in 1978 as a volunteer firefighter with Kentfield Fire in Marin County. He went to work for CAL FIRE in 1980 as a firefighter I in the Sonoma-Lake-Napa Unit. He promoted to FAE in 1986 in the Mendocino Unit and transferred to the Riverside Unit in 1988. Jeff promoted to fire captain in Riverside in 1992 where he worked as an engine and truck captain. In 1997, Jeff transferred to the Nevada-Yuba-Placer Unit. In 2001, Jeff promoted to battalion chief as served as the Dry Creek, Colfax and Auburn battalion chief prior to his retirement in 2013. Jeff served for several years as the operations chief on CAL FIRE IMT #4 and as deputy incident commander on CAL FIRE IMT #5.

Ray Chaney started his career in the fire service in 1984 as a firefighter I in the Riverside Unit. In 1987, he promoted to FAE in the Tulare Unit and subsequently transferred to the San Luis Obispo Unit. In 1994 Ray promoted to fire captain at Ventura Camp and in 1996 went to work as a fire captain air attack officer at the Paso Robles Air Attack Base. In 1999, Ray promoted to field battalion in the San Diego Unit, Campo Battalion. In 2005, Ray transferred to air attack battalion chief at the Ramona Air Attack Base and later that year Ray added additional duties to his workload and became the battalion chief for special operations. Ray served for 16 years on federal and CAL FIRE IMT's as air operations on IMT #10, Operations Chief on IMT #9, and as deputy incident commander and incident commander on IMT #6.

Russ Fowler started his career in 1984 as a firefighter I in the Butte Unit. In 1987, Russ promoted to FAE in the San Mateo-Santa Cruz Unit. Russ promoted to fire captain in 1989 back to the Butte Unit where he worked Schedule A and B and was instrumental in developing the Butte County Regional HazMat Team. In 2002 promoted to battalion chief supervising the Butte ECC and in 2007 transferred to a field battalion chief position in the Oroville Battalion. Russ worked for several years as Operation Section Chief on CAL FIRE IMT #1.