CROSS-TRAINING STANDARDS FOR STRUCTURAL AND FORESTRY PERSONNEL IN URBAN INTERFACE WILDFIRES: ONE ALASKAN SOLUTION

EXECUTIVE ANALYSIS OF FIRE SERVICE OPERATIONS IN EMERGENCY MANAGEMENT

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ABSTRACT

In response to review team recommendations after the Miller's Reach Wildfire of 1996, given the problem of a lack of cross-training standards for structural and wildland fire personnel, the purpose of this applied research project was to develop and adopt cross-training policies and programs for structural and wildland fire personnel in the Mat-Su Borough. Through descriptive, evaluative and action methodologies, the project addressed three primary research questions:

1. What policies and wildland training programs should be adopted for structural firefighters within the Mat-Su Borough?
2. What policies and wildland training programs should be adopted for structural fire officers through the level of task force/strike team leader and/or division supervisor within the Mat-Su Borough?
3. What policies and structural training programs should be adopted for forestry firefighters and supervisors within the Mat-Su Borough?

After reviewing the ideas and recommendations in the literature, and evaluating the wildfire interface training program jointly adopted by Washington and Oregon, the project proceeded with the development and adoption of borough cross-training standards. For structural fire personnel, NFPA 1051(1995), *Wildland Fire Fighter Professional Qualifications,* became the foundation for adoption decisions. NFPA 1051 was revised to de-emphasize forestry crew line construction methods, emphasize urban interface issues and tactics, and focus on the capabilities of structural apparatus. Once agreements with the Alaska Division of Forestry (ADOF)

were reached on NFPA 1051 (1995), attention shifted to programs for meeting the adopted standards. For forestry personnel, structural training pertaining to exterior roles and functions became the agreed upon focus for this area of cross-training.

In an approach similar to an alternative within the Washington/Oregon model, a version of the standard wildland firefighter course—modified to emphasize urban interface wildfires and de-emphasize crew line techniques—was adopted for all borough structural firefighters. Using a combination of borough and National Wildfire Coordinating Group course, functional system for fire officers training was developed and adopted. A pilot program for forestry personnel has been approved by ADOF, and will be delivered in 1999.

This was a highly pragmatic projected designed to raise the level of urban interface wildfire qualifications of fire personnel within the Mat-Su Borough. To a significant degree, the projected has already achieved the goal of improved wildland qualifications among structural fire personnel, and will continue to do so. Fire departments confronting wildland/urban interface issues can utilize this research to gain insights and ideas on potential problems, alternatives and training solutions.

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INTRODUCTION

Due to the growing national wildland/urban interface fire problem, there have been numerous and continuing calls for the cross-training of both structural and wildland firefighters, especially the need to cross-train structural firefighters for interface fire operations (Bailey, 1987; Bailey, 1990; WFCA, 1991; FEMA Task Force, 1992; Perry, 1993; Bisbee, 1994; Winston, 1996; Winston, 1997; Haftl, 1998). In Alaska, prior to the disastrous Miller's Reach Urban Interface Fire of 1996, the need to cross-train structural and wildland firefighters was ignored.

In conjunction with Alaska's Division of Forestry (ADOF), the Matanuska-Susitna (Mat-Su) Borough's Public Safety Department and Fire Chiefs Association began to confront the problem of the lack of cross-training for structural and wildland firefighters in 1997. While borough structural personnel received some wildland education as part of Firefighter I training and a few senior officers had taken one or more wildfire courses, the level of wildland training for all personnel was clearly insufficient. Except for some structural volunteers seasonally employed by ADOF, forestry personnel had received no training pertaining to structural fire suppression concepts. ADOF, the Public Safety Department, and Fire Chiefs Association agreed to jointly develop cross-training policies and programs.

The purpose of this research was to develop and adopt wildland cross-training policies and programs for structural firefighting personnel, including both firefighters and fire officers, and to develop and adopt structural cross-training policies and programs for wildland personnel. Through descriptive, evaluative and action methodologies, this project was initiated with the goal of completing policy

development and initial program deliveries by the start of the 1999 wildland fire season. The following research questions were addressed:

4. What policies and wildland training programs should be adopted for structural firefighters within the Mat-Su Borough?
5. What policies and wildland training programs should be adopted for structural fire officers through the level of task force/strike team leader and/or division supervisor within the Mat-Su Borough?
6. What policies and structural training programs should be adopted for forestry firefighters and supervisors within the Mat-Su Borough?

Based on the answers to these questions, the plan was to adopt and implement the new policies and programs as they were developed and jointly approved by ADOF, the Public Safety Department and Fire Chiefs Association.

BACKGROUND AND SIGNIFICANCE

By state law, all wildland fires on state lands—Bureau of Land Management or the U.S. Forest Service cover federal lands—fall under the jurisdiction of ADOF. Even wildland fires within organized boroughs (Alaska's term for "county") and municipalities remain the legal responsibility of ADOF. One outcome of this situation has been and continues to be an emphasis on cooperative fire protection agreements between ADOF and borough/municipal governments (Flanigan, Murphy and Teie, 1996). It is through such agreements that structural fire departments are authorized, even within their jurisdictional boundaries, to respond to and suppress wildfires.

Cooperative agreements, prior to the disastrous Miller's Reach Urban Interface Fire of 1996, ignored cross-training issues for structural and wildland personnel. In fact, review team recommendations after the Miller's Reach Fire included that the State Fire Marshal should establish wildland training standards and programs for structural personnel, that the Alaska Interagency Wildland Coordinating Group (AIWCG) should provide seats for structural personnel in its annual wildland classes, and that the AIWCG should provide appropriate cross-training for wildland personnel (Flanigan, et al., 1996).

By early 1997, the AIWCG had opened its courses to structural firefighters and officers, and increased the regional availability of wildland courses within the urban interface areas of Alaska. Unfortunately, by the spring of 1997 (one year after the Miller's Reach Fire), neither the State Fire Marshal nor the AIWCG chose to act on the cross-training recommendations (neither had acted on the cross-training recommendations by the end of 1998). This lack of action by the State Fire Marshal and AIWCG caused ADOF and the Mat-Su Borough to address the cross-training issues.

ADOF and the Public Safety Department believed that continuing delays in addressing the cross-training issues were neither legally nor morally defensible. ADOF had no structural cross-training options or programs for wildland personnel. Through its Firefighter I training package (Murdock, 1993), the Public Safety Department provided six hours of wildland training designed to exceed NFPA 1001 (1992), *Fire Fighter Professional Qualifications.* NFPA 1001 (1992) contained one wildland reference, "Explain the procedures for extinguishing ground cover fires (p.

10)." In addition to direct and indirect fire attack methods, the Public Safety Department also covered wildland tools/equipment, wildland protective clothing and safety, elements of a wildfire, the components of the wildland fire triangle (fuel, weather, topography), and unified command policies between ADOF and the Mat-Su Borough. However, with a six-hour time frame, the depth of coverage was deemed insufficient.

The joint ADOF and Mat-Su Borough decision to proceed with the cross-training development was largely based on the present and future wildland/urban interface concerns in south central Alaska. Many have documented the growth of the wildland/urban interface problem across the country (NFPA, 1987; Davis, 1989; FEMA Task Force, 1992; Perry, 1993; Berry, 1995; Cooney, 1997). Bailey (1991) noted that the number of people moving into the wildland/urban interface is more than double the country's rate of population growth. Alaska has led (Davis, 1989) and continues to lead the nation in the rate of wildland/urban interface population growth. For example, over a nine year period, the population of the Mat-Su Borough grew from under 40,000 to over 60,000, and all live in the wildland/urban interface.

Laughlin and Page (1987) and Davis (1989) proposed the consideration of and planning for three types of wildland/urban interface situations: (1) mixed-interface where homes and structures are intermixed with wildland vegetation, (2) classic-interface where city and suburban boundaries are adjacent to wildland vegetation, and (3) occluded-interface where islands of wildland vegetation occur inside metropolitan areas. The Mat-Su Borough's Public Safety Department incorporates all fire, ambulance and rescue services protecting a population of over

60,000 within an area larger than 1200 square miles. Except for mountain areas above the treeline and land cleared for farming or development, forests of birch, spruce and black spruce cover the borough. Most of the structures and population are within mixed-interface wildland areas, and the remainder is at risk due classic-interface and/or occluded-interface wildland areas. Although the rate of population growth has been somewhat slower than the Mat-Su Borough, ADOF faces a similar and growing urban/interface problem throughout all of south central Alaska. In 1997, there were 207 wildfires in south central Alaska with the potential to threaten structures (WN&N, 1998).

Given the cross-training needs for structural and wildland personnel identified by the Miller's Reach review team (Flanigan, et al., 1996), given the lack of action on the cross-training needs by the State Fire Marshal and AWICG, given the present and future wildland/urban interface growth facing both ADOF and Mat-Su Borough, and given the insufficiency existing wildland training for borough personnel, ADOF and the Mat-Su Borough's Public Safety Department and Fire Chiefs Association agreed to jointly address the identified cross-training issues. This author was selected by the Public Safety Department and Fire Chiefs Association to serve as the liaison with ADOF, and was designated by all groups to be the primary policy and program developer.

The assignment of this author to the cross-training project was directly related to the Executive Fire Officer (EFO) Course, *Executive Analysis of Fire Service Operations in Emergency Management.* In the course units on Community Risk Assessment (p. 4-10) and Capability Assessment (p. 6-5), the executive fire officer is

instructed to identify training needs and assure that the identified needs are met (NFA-EAFSOEM, 1998). Given the identified wildland and structural firefighting cross-training needs, the goal of policy development and program delivery is linked to the EAFSOEM course.

LITERATURE REVIEW

Dunn (1996) defines the wildland/urban interface as the modern "conflagration" problem confronting the nation's fire service. The potential for a fire originating in a structure or the forest to spread over a large area or distance and devastate a community/region should make the wildland/urban interface a top priority for fire service planners. The continuing growth of population/structures at risk within the wildland/urban interface (Davis, 1989; Bailey, 1991; FEMA Task Force, 1992; Perry, 1993; Berry, 1995; Cooney, 1997) yields an annual increase in the conflagration potential confronting the fire service. Whether one looks at lists/examples of devastating wildland/urban interface fires (Wilson, 1988; Reynolds, 1989; Dektar, 1989; Perry, 1990; FEMA Task Force, 1992; Burastero, Cates, Fowler & Sullivan, 1993; Winston, 1996; Cooney, 1997; Winston, 1997; Clark & Hardy, 1997), or at the incidents of firefighter fatalities during wildfires (Swinford, 1989; Dunn, 1996; Mangan, 1998a; Mangan, 1998b), the inescapable conclusion is that the wildland/urban interface conflagration potential is very serious and growing.

For several authors (Swinford, 1989; Gray, 1994; Bisbee, 1994; Dunn, 1996; Bullock, 1996), the cross-training issue is directly linked to concerns for safety. While most structural fire chiefs would never send an untrained or wrongly dressed firefighter into a burning structure, many are sending firefighters in full structural

turnouts to fight urban interface fires for which they have little, if any, training (Bisbee, 1994). Gray (1994) notes that many wildland firefighters and supervisors have little training or preparation for operating in a wildfire environment when one adds numerous structures into the forest. In addition to safety, firefighters are likely to perform poorly in fire environments for which they are inadequately trained. Chiefs will either assume responsibility to assure their personnel have adequate wildland/urban interface fire training, or they are likely to be held liable by injured personnel and irate property owners.

Given the concerns over wildland/urban interface conflagrations and safety, one finds many authors concerned over cross-training for structural firefighters, structural fire officers, and/or wildland firefighters. Most common is the position that structural firefighters must be trained for wildland/urban interface fire operations (NFPA, 1987; Bailey, 1987; Bailey, 1990; WFCA, 1991; Bailey, 1991; Smith, 1991; FEMA Task Force, 1992; Perry, 1993; Burastero, et al., 1993; Bisbee, 1994; Gray, 1994; Winston, 1996; Bullock, 1996; Dunn, 1996; Cooney, 1997; WA/OR, 1997). The emerging consensus is that if structural firefighters will (nature of jurisdiction) or may (mutual aid) be involved in wildland/urban interface fires, then they must be appropriately trained for interface operations.

Although not as pervasive, there are a variety of suggestions on the wildland training needed for structural fire officers. The wildland training levels suggested for structural fire officers vary from fairly minimal (Winston, 1996; NFA-IWFSCO, 1998), to adoption of NFPA 1051 (1995), *Wildland Fire Fighter Professional Qualifications* (Bisbee, 1994), or to adoption of the complete wildland training system as listed in

the NWCG 310-1 (1993), *Wildland Fire Qualification Subsystem Guide* (Cooney, 1997). Smith (1991) argues that structural officers need task force/strike team leader training in addition to wildfire training. The Western Fire Chiefs (WFCA, 1991) recommend California's suggested list of training courses. Washington and Oregon (WA/OR, 1997) have created a joint qualification system for wildland/urban interface officers. While there is consensus that structural fire officers require training to confront the wildland/urban interface fire, there is no consensus as to the extent and magnitude of such training.

For wildland firefighters who may operate in the wildland/urban interface, especially those who may work with structural forces, there have been a variety of calls and suggestions for appropriate structural training (NFPA, 1987; Bailey, 1987; Bailey, 1990; Bailey, 1991; FEMA Task Force, 1992; Gray, 1994; Bullock, 1996). Except for the thirty-two hour S-205 course, *Fire Operations in the Urban Interface* (NWCG 310-1, 1993), the wildland firefighter receives no training for combating fires in structural environments or working in conjunction with structural firefighting forces. In fact, the S-205 course is only required for Type 4 Incident Commanders and Task Force Leaders. S-205 is not required to lead any type of Strike Team. While S-205 is listed as a requirement for Division/Group Supervisors, this author's experience on two Type I fires and one Type 3 fire has found that the requirement has been generally ignored in Alaska.

Interface specific courses and training are lacking in the NWCG system (WA/OR, 1997). In fact, the NWCG has a group that has been exploring the training needs of wildland firefighters for the urban interface (USDI, 1995). However, except

for suggesting that wildland personnel receive self-containing breathing apparatus training (T. Dean, personal communication, October 2, 1998), no changes or recommendations have been sent to the AIWCG from the NWCG.

The frustration created by the lack of interface training in the NWCG system has caused some areas to make regional modifications in wildland firefighter training. For the wildland firefighter (labeled “FFT2”), the NWCG (310-1, 1993) requires S-130 (*Firefighter Training)* and S-190 (*Introduction to Fire Behavior),* and recommends I-100 *(Introduction to ICS).* Alaska in 1995 added structural triage, structural preparation and structural protection components to its FFT2 course (Stam, Wilcock, Kurth & Purcell, 1996). Washington and Oregon (WA/OR, 1997) proposed a similar model and designated it as Interface-FFT2. Typically, these modified FFT2 courses with interface components are around twenty-four hours in length.

Given a growing wildland/urban interface conflagration potential and firefighter safety problem throughout the United States, and given the cross-training needs of structural and wildland personnel to combat interface fires, what programs and/or requirements have been implemented to address cross-training needs? The fundamental answer is surprisingly little.

What cross-training options are available for structural firefighters? The Western Fire Chiefs (WFCA, 1991) recommend the NWCG S-130, S-190 and I-100 package. Unfortunately, even in California where this package is recommended, it is not required and under-utilized by structural fire departments (Bisbee, 1994; Cooney, 1997). The Washington/Oregon Interface System (WA/OR, 1997) requires

the FFT2 requirement of S-130 and S-190 or equivalent training (equivalency documentation submitted to appropriate state board) for structural firefighters to participate in interface wildfire incidents covered under Washington/Oregon mobilization statutes. The Interface-FFT2 is also accepted. Alaska's Wildland Interface Firefighter (Stam, 1996) course is open to structural personnel; however, since the focus of this course is directed toward hand-crew operations, structural departments have shown little interest in the course. In short, a basic or enhanced FFT2 of the NWCG is the cross-training option being provided to structural firefighters. While Washington/Oregon have implemented the FFT2 requirement, other states and jurisdictions make FFT2 training for structural personnel strictly optional.

What cross-training options are available for structural fire officers? The National Fire Academy (NFA) and NWCG have developed a sixteen-hour wildland/urban interface course for structural company officers (NFA- IWFSCO, 1998), and it is essentially S-190 with some material from S-205. For the metropolitan fire company officer who may, on very rare occasions, be mobilized for an interface conflagration and command a single piece of apparatus, the course would be valuable. Some training is better than no training. However, for structural officers within jurisdictions with a wildland/urban interface fire potential, for structural officers who are likely on an annual basis to be mobilized for an interface fire, and for structural officers who may command a task force or wildland incident, the NFA-NWCG package is insufficient (conclusion of structural officers with major wildland

experience during August 98 pilot). The NFA-NWCG package is useful but not sufficient for structural fire officer wildland training.

The Western Fire Chiefs (WFCA, 1991) provide a mixed message on structural fire officer wildland training. While listing the full range of NWCG courses for company, mid-level and command officers, they conclude with the advice, "Do as much as you can (p. 87)." Recommendations without setting even minimum priorities or requirements are of little value (Bisbee, 1994).

In contrast, Washington/Oregon (WA/OR, 1997; Firewise, 1998), using NWCG courses, are more focused and directive. "Positions not meeting 310-1 qualifications shall be identified as an 'Interface Position' (p. 6)," and an Interface Qualification Matrix is provided (WA/OR, 1997, p. 18). In addition to firefighter training, fire officer interface training currently relies primarily on S-205, *Fire Operations in the Urban Interface,* and S-290, *Intermediate Fire Behavior*, through the Division/Group Supervisor level. By 2002, the following courses are added as interface requirements: S-336, *Fire Suppression Tactics* (Task Force/Strike Team Leader); S-390, *Fire Behavior Calculations* (Division/Group Supervisor); I-300, *Intermediate ICS* (Division/Group Supervisor). A comprehensive list of Command and General Staff requirements are also defined for interface operations which utilize NWCG courses, but fail to meet all NWCG course requirements. With the possible exception of the Interface-FFT2 course, Washington/Oregon have created a wildland interface qualification system by selecting from among existing courses without creating new courses. However, Washington/Oregon recommended to the NWCG that an "interface curriculum be developed for all levels of ICS position (p.8)."

Whatever one's assessment of the Washington/Oregon Interface Qualification System, both states must be credited with adopting and implementing a functional system.

What cross-training options are available for wildland firefighters? From one perspective, the S-205 course, *Fire Operations in the Urban Interface,* is a minimal attempt by the NWCG to provide the wildland firefighter some training for interface wildfires. As noted by Washington/Oregon (WA/OR, 1997), S-205 is clearly not sufficient. Alaska's decision in 1995 to add structural triage, structural preparation and structural protection components to its FFT2 course (Stam, et al., 1996) can be viewed as an attempt to provide some minimal structural background for wildland personnel within the state.

However, neither the NWCG nor Alaskan efforts addressed the structural cross-training needs of wildland firefighters as identified in the literature. For wildland firefighters, Bailey (1987) listed needed training areas that included structural fire behavior, suppression techniques, hose types and evolutions, fire stream capabilities and flows, ladder carriers and raises, water supply options, and apparatus capabilities. During urban interface wildfires, wildland firefighters are likely to operate with and may need to support structural forces. Just as the structural personnel must develop competencies with forestry equipment and concepts, the wildland firefighter needs some competencies drawn from structural training (FEMA Task Force, 1992; Gray, 1994). Gray (1994) views structural firefighting training as supplemental to initial wildland training, but argues that it is essential within the continuing education process.

While the California Division of Forestry (CDF) has a defined structural firefighting mission and mandates NFPA 1001 (1997) certification of its personnel, many, if not most, wildland personnel are prohibited from structural firefighting. If one assumes that wildland personnel may be needed during an interface fire to adopt exterior structural roles to assist one or more structural fire companies, then the list offered by Bailey (1987) appears reasonable. To that list, given the toxicity of smoke from a structure, car or other hazardous products burning during an interface fire, training in self-contained breathing apparatus for wildland personnel should also be a priority. Since structural engines and tenders are seldom fully staffed for a wildfire (less personnel than seats), breathing apparatus will likely be available for the use of wildland personnel during an emergency. During an interface wildfire, structural forces may be required and should be trained to support a fireline. There are also circumstances where wildland firefighters may need to support structural forces with a burning structure. Structural cross-training for wildland firefighters is needed to prepare them for supporting and exterior roles. Much more attention must be devoted to the cross-training requirements for wildland firefighters.

The literature review confirmed the direction of needed cross-training efforts suggested during the Miller's Reach Fire Review (Flanigan, et al., 1996). A variety of authors supported the need to cross-train structural firefighters, structural fire officers, and wildland firefighters. For structural firefighters, perhaps with some "interface" additions (Stam, 19996; WA/OR, 1997), there is a consensus that the NWCG FFT2 program (S-130 and S-190) should serve as the basis for this area of cross-training. For structural fire officers, the Washington/Oregon Interface

Qualification System (WA/OR, 1997) offers one regional standard, although the approaches elsewhere are non-existent or more laissez faire. Despite several calls for some structural training for wildland personnel as a result of the interface wildfire conflagration potential, no programs or efforts to address this concern were identified.

Because the initial review of literature confirmed the basic thrust of the recommendations for cross-training contained in the Miller's Reach Fire Review (Flanigan, et al., 1996), the Public Safety Department, Fire Chiefs Association and ADOF committed to this research project in May, 1997.

PROCEDURES

In order to adequately address the cross-training research questions and reach the goal of program implementation by the Spring 1999, the project's procedures were divided into three phases: The job function phase using a consensus model, the assessment phase using descriptive and evaluative methods, and the implementation phase using action methodology.

The Job Function Phase

Before attempting to identify appropriate cross-training policies and programs, there was a need to reach consensus on the roles and responsibilities of structural and wildland personnel during joint operations. Three preliminary questions were addressed:

1. For structural firefighters operating from structural apparatus, what are their roles and responsibilities during interface or other wildfires involving joint operations with forestry forces?

2. For structural fire officers operating from structural apparatus, what are their roles and responsibilities during interface or other wildfires involving joint operations with forestry forces?
3. For wildland firefighters and supervisors, what are their roles and responsibilities during interface or other wildfires involving joint operations with structural forces?

All involved agreed that answers to these questions would facilitate agreement on the project's primary research questions that were addressed during the assessment phase.

The Assessment Phase

During the assessment phase, the following research questions were addressed:

1. What policies and wildland training programs should be adopted for structural firefighters within the Mat-Su Borough?
2. What policies and wildland training programs should be adopted for structural fire officers through the level of task force/strike team leader and/or division supervisor within the Mat-Su Borough?
3. What policies and structural training programs should be adopted for forestry firefighters and supervisors within the Mat-Su Borough?

The Implementation Phase

As the research questions were resolved during the assessment phase, the plan was to adopt and implement the new policies and programs as they were

developed and jointly approved by ADOF, the Public Safety Department and Fire Chiefs Association.

RESULTS

The Job Function Phase

Critical to any agreement concerning job functions is a common understanding of protection/suppression priorities during a wildfire event. Fortunately, federal, state, tribal and local officials had resolved this potential area of conflict during the 1980's. While all wildland areas of Alaska are categorized into one of four protection priority categories, any area or structures normally populated by people have the highest protection/suppression priority (Hanson & Rowdabaugh, 1989). Consequently, ADOF and structural fire departments share a common mission and set of priorities during an interface wildfire event.

The initial preliminary question addressed was: For structural firefighters operating from structural apparatus, what are their roles and responsibilities during interface or other wildfires involving joint operations with forestry forces? During a August 1997 meeting, this researcher and ADOF representatives agreed to adopt the competencies for Wildland Firefighter I (NFPA 1051, 1995) with two qualifications. Emphasis would be shifted from a wildland fire crew focus (e.g., delete small portable pumps; de-emphasize crew line construction methods) to a fire company focus, although time would be devoted to methods by which fire companies could support/assist wildland fire crews. The interface competencies as added to the Alaskan FFT2 package would be added to the NFPA 1051 competencies. With their assigned apparatus as a base, structural firefighters would

engage in and support fire suppression/containment activities within 1000 feet of the apparatus. At a September 1997 meeting between ADOF, the Borough Public Safety Department, and Mat-Su Fire Chiefs Association, this agreement was ratified.

The second preliminary question addressed was: For structural fire officers operating from structural apparatus, what are their roles and responsibilities during interface or other wildfires involving joint operations with forestry forces? After several meetings and phone discussions, all involved agreed in March 1998 to adopt the Wildland Firefighter III & IV criteria of NFPA 1051 (1995) after modification to limit the competencies to the capabilities of structural personnel and apparatus. Wildland Firefighter III (NFPA 1051, 1995) was revised to state: The person responsible for supervising and directing a single structural resource (engine, brush engine or tender) during a wildfire operation. Wildland Firefighter IV (NFPA 1051, 1995) was revised to state: The person responsible managing the all aspects of a wildfire incident or part of a wildfire incident involving structural resources (engines, brush engines and tenders) up to the strike team or task force level. ADOF agreed to accept these qualifications for wildfire incidents inside the Mat-Su Borough and for strike team/task force assignments of borough resources elsewhere in Alaska.

Additional adopted agreements concerning structural fire officers were on the basis of incident size and duration, and not limited to wildfire incidents, but are limited to incidents within the Mat-Su Borough. For Type 4 & 3 incidents, structural officers meeting the revised Wildland Firefighter IV criteria could be assigned division/group supervisor responsibilities. However, for Type 2 & 1 incidents, structural officers meeting the revised Wildland Firefighter IV criteria would only be

assigned to the division/group supervisor level when the position could be jointly staffed with forestry personnel. For Type 4 & 3 incidents, command and general staff positions could be filled by structural fire officers or other borough personnel on the basis of criteria established by the Mat-Su Borough's Public Safety Department. However, For Type 2 & 1 incidents, while a unified command would be established, command and general staff positions would only by filled by borough personnel on a joint staffing model.

The third preliminary question addressed was: For wildland firefighters and supervisors, what are their roles and responsibilities during interface or other wildfires involving joint operations with structural forces? While structural protection is the highest priority for wildland firefighters in Alaska, they are prohibited from direct structure fire suppression. After extensive discussions on structural cross-training for wildland firefighters, ADOF agreed in October 1998 to a pilot program involving structural fire behavior, self-contained breathing apparatus training, and exterior structural roles. The pilot will be limited to full-time and permanent seasonal forestry fire suppression personnel in the borough (seventeen individuals).

The Assessment Phase

In addition to the agreements reached during the job function phase, two other considerations influenced cross-training policy and program decisions. First, although somewhat mundane, careful consideration was necessary on the availability of both structural and wildland personnel for additional training. ADOF relies heavily on permanent seasonal personnel. For example, fifteen of seventeen permanent forestry line positions in the Mat-Su Borough are seasonal (most five

months). While ADOF has been advised to increase the number of seasonal personnel and their length of employment in order to allow for more training (Flanigan, et al., 1996), the state legislature has repeatedly refused the funds to do so. Consequently, except for FFT2 classes, virtually all forestry training in Alaska is limited to April-May each year. At best, forestry personnel can take two or three classes a year. Since positions are seasonal, personnel retention over several years is a constant problem. Also, if the fire season starts early, fairly common in south central Alaska, an entire year's training cycle can be destroyed. Obviously, given these factors, structural cross-training for wildland personnel must be restricted in scope and duration.

The availability of most structural personnel for additional cross-training is not much better. With the exception of the fully career fire departments of Anchorage and Fairbanks, over 95% of the structural firefighters in the Mat-Su Borough and throughout Alaska are volunteer or paid-on-call. Within the Mat-Su Borough, in addition to weekly in-service training, one or more fire, rescue or EMS training events is conducted forty or more weeks each year. The average firefighter or fire officer is directly involved in only a small part of these training events. However, with required weekly in-service training, mandated national standard training, required officer training, and additional annual training requirements for any skill or function specialty, an average of over 200 hours of annual training is typical.

Given the limited availability of both structural and wildland personnel to meet additional training requirements, pragmatic time parameter decisions had to be jointly adopted before the assessment phase could be completed. By March 1998, a

working set of time parameter objectives was adopted. For forestry firefighters, the cross-training structural package would be no more than forty hours. For structural firefighters and fire officers, the new requirements would total no more than 100 additional hours of training, although other forestry courses would be offered and supported as electives.

Second, given the limited training window of April-May for most forestry course offerings, and given the limited funds available to AWICG to support additional courses or seats within regular courses for structural personnel, any agreed upon new cross-training requirements for structural and wildland firefighters had to be limited to a model that was both deliverable and sustainable. Whenever possible, the Mat-Su Borough's Public Safety Department and Fire Chiefs Association agreed to provide from its own staff and available pool of certified instructors the staffing necessary to deliver the structural cross-training for forestry personnel and agreed upon forestry courses to structural personnel. ADOF agreed to offer in the south central region any adopted NWCG courses, at a minimum, once every other year.

The decisions on number of new training hours due to the availability of structural and wildland firefighters, instructor staffing, and frequency of NWCG course offerings were pragmatic. If the new cross-training policies and programs were to be viable and sustainable, the decisions on those programs required accommodation to the reality of permanent seasonal forestry personnel and a largely volunteer pool of structural firefighters, as well as limited availability of NWCG courses.

What policies and wildland training programs should be adopted for structural firefighters within the Mat-Su Borough? Once ADOF, the Borough Public Safety Department, and Mat-Su Fire Chiefs Association had ratified Wildland Firefighter I (NFPA 1051, 1995) as modified and strengthen with specific interface competencies as a component of the Borough's structural firefighter position, training programs had to be created to address this expanded definition of structural firefighter responsibilities.

I-100, *Introduction to ICS* (a NWCG take home self-study package) was selected as a requirement for all current and new fire personnel. For the wildland firefighter (FFT2), the NWCG (310-1, 1993) requires S-130 (*Firefighter Training)* and S-190 (*Introduction to Fire Behavior).* S-190 was adopted. S-130 materials were modified to add the interface competencies of the Alaska Wildland Interface Firefighter package (Stam, 1996), to delete small forestry pumps, and to de-emphasize crew fireline materials. This author combined S-190 and modified S-130 materials into the Alaskan Structural Forces Wildland Interface (ASFWIF) program. A copy of the program's current manual is in Appendix A. After review and approval by ADOF, sixteen hours were added to the borough's introductory firefighter training program to deliver ASFWIF.

What policies and wildland training programs should be adopted for structural officers through the level of task force/strike team leader and/or division supervisor within the Mat-Su Borough? With agreements adopted on the revisions of Wildland Firefighter III and IV from NFPA 1051 (1995), the parties involved had to agree on criteria and programs for structural fire officers to meet these qualifications. These

agreements were reached over eighteen months and ratified at a joint ADOF, borough, and fire chiefs meeting in November 1998. The agreements are outlined in Figure 1.

Figure 1: Adopted Wildland Training Requirements
For Mat-Su Borough Firefighters & Fire Officers

	Minimum Requirements	**Elective Options**
Firefighters	ASFWIF I-100, Intro. to ICS	Alaska FFT2 Course S-211, Portable Pumps S-212, Power Saws
Fire Officers (Company Officer)	MSB, Strategy & Tactics For Officers	NFA—Interface Course for Company Officers
Fire Officers (Task Force/Strike Team Leader)	S-290, Intermediate Wildland Fire Behavior S-205, Fire Operations in The Urban Interface MSB, Managing Forms	I-200, Basic ICS S-230, Crew Boss S-231, Engine Boss S-330, Task Force/Strike Team Leader S-336, Fire Suppression Tactics S-234, Firing Methods & Procedures S-390, Intro. to Wildland Fire Behavior Calculations S-270, Basic Air Operations I-300, Intermediate ICS S-301, Leadership & Organizational Development S-260, Interagency Incident Business Management
Fire Officers (Jointly staffed—MSB & Forestry—Division Supervisor Level)	I-200, Basic ICS	NFA—R801, Fire Command Operations

The requirements for each officer level presume that the minimum requirements of the previous levels have been met. With the exception of the ASFWIF, Mat-Su Borough (MSB) and National Fire Academy (NFA) courses, the required and elective options are NWCG courses. ADOF agreed to accept two NFA courses as electives. In addition to the ASFWIF course, ADOF agreed to accept two MSB courses as requirements. The MSB Strategy & Tactics for Officers course is an existing twenty-four hour required course for all fire officers in the borough. Instead of requiring the NWCG S-260 course, the borough agreed to develop a sixteen hour course (MSB Managing Forms) to prepare fire officers to complete and process the typical range of incident forms for a wildland/urban interface fire. For fire officers wanting to qualify for joint staffing at the division supervisor level for Type 2 & 1 incidents, I-200 is a mandated requirement. While only a few of the elective courses are available in a typical year, all involved agreed to utilize the NFA and NWCG courses when available to enhance fire officer competency levels.

The two key courses selected for structural fire officers are S-205, *Fire Operations in the Urban Interface,* and S-290, *Intermediate Fire Behavior*. Like Oregon and Washington (WA/OR, 1997), S-205 and S-290 were identified as the two NWCG courses with the most direct application for urban interface wildfires. As part of the process in arriving at this adoption decision, fire officers were sent to a variety of NWCG courses as they became available throughout south central Alaska. Consensus of borough fire officers and ADOF was that the S-205 and S-290 were the best of several valuable courses (S-234 and S-330 were also highly regarded).

Figure 2 contains the total number of new training hours required for volunteer personnel to qualify for the urban interface wildfire positions. Through the task force/strike team leader level, the new training hours total 100 and meet the agreement with ADOF. The additional sixteen hours for I-200 were considered essential for those wanting to meet the joint staffing requirements for Type 2 & 1 incidents.

Figure 2: Additional Wildland Training Hours
For Structure Fire Personnel

Firefighter	ASFWIF	16 hours
	I-100	4
Company Officer	Strategy & Tactics	0 hours (Already mandated)
Task Force/Strike Team Leader	S-290	32 hours
	S-205	32 hours
	MSB Managing Forms	16 hours
Division Supervisor	I-200	16 hours
	Total	116 hours

What policies and structural training programs should be adopted for forestry firefighters and supervisors within the Mat-Su Borough? With the agreement among the three parties to limit structural cross-training to structural fire behavior, self-contained breathing apparatus, and exterior structural roles, this author was assigned to revise the borough's initial firefighter training package into a much shorter version for wildland personnel. The manual for this program was accepted

by ADOF and is in Appendix B. It is designed to be taught in a thirty-two hour course.

The Implementation Phase

The ASFWIF course was pilot tested during the Fall 1997. After a couple of minor revisions, it was incorporated into the borough's initial training program and also delivered to current firefighters in 1998. It has been taught a total of nine times with 148 firefighters and fire officers completing certification. During the Spring 1999, it will be delivered three more times. The objective of having 200 structural firefighters complete the program by the wildland season of 1999 should be achieved. The ASFWIF material will remain as a permanent component of the borough's initial firefighter training program.

Throughout the meetings and discussions on structural fire officer wildland training requirements, structural fire personnel were placed in all NWCG courses offered in south central Alaska. The MSB Managing Forms course is being developed, and will be initially offered in April 1999. With this course as an exception, eleven structural fire officers have satisfied all other agreed upon minimum requirements. An additional five officers have completed both S-205 and S-290, twenty-four officers have completed S-205, eleven officers have completed S-290, and twelve officers have completed I-200. A total of thirty-one officers have completed one or more of the elective NWCG or NFA courses. In addition, the Public Safety Department has qualified certified instructors to teach all required courses with the exception of S-205 and S-290.

During February 1999, the I-200 course will be offered. During April 1990, the S-205 course will be offered. During the winter of 2000, the MSB Managing Forms, the I-200 and the S-290 courses will be offered. ADOF and AIWCG have agreed to continue to offer on alternating years the S-290 and S-205 courses. By the start of the wildland season for 2000, around twenty-five fire officers should meet all minimum requirements.

Permanent seasonal forestry personnel in south central Alaska begin work in early April. The initial pilot of the Structural Firefighting for Wildland Firefighters course will be taught April 6-9, 1999. After the pilot, its assessment and, if necessary, course revision, ADOF will decide on the frequency of future offerings. From among its full-time, permanent seasonal, seasonal crew and temporary FFT2 personnel, ADOF will also have to designate the future target students.

DISCUSSION

After the Mat-Su Borough's Public Safety Department, Fire Chiefs Association, and ADOF agreed to jointly develop cross-training policies and programs for structural and wildland personnel as recommended by Flanigan, et al. (1996), the literature review confirmed the decision. In terms of wildland/urban interface fires, a variety of authors advocated the need to cross-train structural firefighters, structural fire officers, and wildland firefighters. Given that all structures within the Mat-Su Borough are in a wildland interface setting (Laughlin & Page, 1987), the participants committed to long-term project.

As the project developed, the participants found it valuable to re-write the job functions for the target groups of fire personnel. For structural personnel, while it

was modified by adding an interface focus and reducing the forestry crew emphasis, NFPA 1051 (1995), *Wildland Fire Fighter Professional Qualifications,* was found to be one useful basis for establishing training program parameters. By defining the roles and functions of structural fire apparatus, firefighters and fire officers, the participants established criteria for later decisions on training program development and/or selection. For wildland personnel, in the absence of established role and function criteria, ADOF eventually agreed to accept an exterior role for wildland firefighters in support of structural personnel as long as the use of self-contained breathing apparatus was emphasized.

The decisions concerning the length/amount of new cross-training requirements for structural and wildland fire personnel pre-established program parameters which limited course requirement options. Factors which entered into these decisions were the limited availability of volunteer and paid-on-call structural personnel to meet additional training requirements, the limited availability of seasonal forestry personnel for any type of training, the number of new courses the Mat-Su Borough's Public Safety Department could fund and deliver, and the limited ability of AWICG to provide NWCG courses to structural personnel. All participants adopted the viewpoint that new cross-training requirements had to be viable and sustainable for the present and future.

With redefined job functions for targeted personnel and program length parameters established, attention shifted to decisions on the project's research questions. For structural firefighters, the new wildland training requirements are the I-100, *Introduction to ICS,* and ASFWIF course. The ASFWIF course consists of S-

190, *Introduction to Fire Behavior* and S-130, *Firefighter Training* (*modified* to include interface competencies and de-emphasize forestry crew competencies). Both NWCG (310-1, 1993) and the Washington/Oregon (1997) make I-100 a recommended elective for firefighters, but all project participants opted to require this ICS training for new entry-level structural firefighters. The ASFWIF course is similar to Washington/Oregon's (1997) Interface-FFT2 course and Alaska's (Stam, 1996) Wildland Interface Firefighter (modified FFT2) course. However, once ADOF and the Mat-Su Borough agreed that structural personnel would engage in and support wildfire suppression/containment activities (including wildland crews) within 1000 feet of assigned apparatus and not serve as forestry crew members, it was possible to de-emphasize the crew material in the FFT2 NWCG course. The I-100 and ASFWIF courses will train the borough's structural firefighters to carryout wildfire or wildland/urban interface fire responsibilities as defined by the borough and ADOF.

For structural fire officers, the Mat-Su Public Safety Department and Fire Chiefs Association insisted that ADOF recognize the validity of training outside the NWCG system. With the training requirements for each officer level assuming lower level requirements as prerequisites, ADOF recognized other training as part of the qualification system. For example, with the tactical information on fireline construction and interface fires in the ASFWIF course, ADOF agreed that borough mandated training in strategy and tactics was sufficient for officers supervising fire apparatus. When ADOF agreed to recognize two NFA courses as electives, the borough agreed to utilize an array of NWCG courses as electives when they are available in south central Alaska. At times, wildfire agencies have used evaluation

boards to assess non-NWCG training in terms of equivalency (WA/OR, 1997). However, in terms of the knowledge of ADOF representative and this author, this is the first time a wildfire agency has agreed to recognize non-NWCG courses as part of a wildland qualification system.

After completing ASFWIF, the adoption of S-290, *Intermediate Wildland Fire Behavior,* and S-205, *Fire Operations in the Urban Interface,* represent the major new requirements for structural fire officers to function as task force/strike team leaders. While this meets the current task force/strike team leader requirements of Washington/Oregon, by the year 2000 they will also require S-336, *Fire Suppression Tactics* (WA/OR, 1997). The joint decision of ADOF, Borough Public Safety Department and Mat-Su Fire Chiefs Association was to limit the requirement to S-205 and S-290 for two pragmatic reasons. S-336 will be taught in Alaska in 1999, but it is the first offering since 1993. AWICG can sustain regional offerings of S-205 and S-290 on an alternating year cycle. Without cutting other courses for wildland personnel, it cannot sustain supporting additional NWCG courses for structural fire officers. Further, the borough's representatives strongly resisted an additional thirty-two hour course requirement for volunteer and paid-on-call personnel.

While I-200, *Basic ICS,* was added for those wishing to serve as division supervisors, the participants agreed to adopt a different approach to this level of staffing. The adopted approach pertained to the type or magnitude of incident. For the smaller Type 4 & 3 incidents, fire officers meeting the task force/strike team leader criteria with I-200 are deemed qualified to supervise a division. However, for

the lager Type 2 & I incidents, fire officers qualified to this extent can only staff a division on a joint staffing model with forestry personnel. In fact, joint staffing at the division level was used with forestry/fire officer personnel during the Miller's Reach Fire in areas with large numbers of structures, and the joint staffing proved effective. While this policy is less than ideal, AWICG cannot provide the number of NWCG 300 level courses required to even consider another approach.

The impact and utility of the pilot Structural Firefighting for Wildland Personnel on forestry personnel has yet to be determined. All participants agree that for forestry and structural personnel to operate effectively together during interface wildfires, forestry personnel must have some cross-training in terms structure fire concepts. Whether the April 1999 pilot will effectively address these cross-training needs will be determined during the pilot and its follow-up assessment.

The impact of this project in terms of wildland training policies and programs for structural firefighters has already been extensive. It has improved the level of wildfire protection for the citizens of the Mat-Su Borough. By redefining the job functions of structural firefighters to include modified versions of many wildland firefighter requirements in NFPA 1051 (1995), the Mat-Su Borough’s Public Safety Department and Fire Chiefs Association have permanently changed the training standards for their structural fire personnel. From the start of the project through the end of 1998, the borough’s volunteer and paid-on-call structural fire personnel have spent 6,464 person hours in wildland training. Annual projections for personnel wildland training hours are between 2,500 and 3,000. Whether the change is adding an additional weekend to the borough’s introductory firefighter training program

(taught four-to-six times a year) or scheduling/staffing NWCG courses with AWICG, the impact of this project has positively changed the qualifications of the borough's fire personnel. In terms of operational effectiveness during wildfire events, both personnel performance and safety have improved. An additional change has been the observed improved effectiveness of joint operations with forestry personnel during the summer of 1998.

RECOMMENDATIONS

This project began as a response to the problem of identified cross-training needs for structural and wildland firefighters in Alaska (Flanigan, et al., 1996). While it is beyond the power of the project participants to address the identified cross-training needs for the state, it was within their power to address these needs within the Mat-Su Borough. Through research questions, the purpose of this research was to develop/adopt wildland cross-training policies and programs for structural firefighters and fire officers, and to develop/adopt structural cross-training policies and programs for wildland personnel. For structural firefighters, policies and programs were adopted and delivered. With the exception of a Managing Forms course to be initially delivered in April 1999, policies and programs for structural fire officers were adopted and delivered. While the initial pilot will occur in April 1999, a Structural Firefighting for Wildland Firefighters program (see Appendix B) was develop and accepted by ADOF. The problem of a lack of cross-training for structural and wildland fire personnel has been addressed. Although a few elements will be implemented in 1999, the project's purpose has been functionally achieved.

Wildland/urban interface fire incident after incident across the country confirms Dunn's (1996) analysis that the wildland/urban interface is the modern "conflagration" problem confronting the nation's fire service. Every fire department must decide the extent to which it has a wildland/interface problem within its jurisdiction and/or through local/regional mutual aid. This author concurs with others (Bailey, 1987; Smith, 1991; FEMA Task Force, 1992; Bisbee, 1994; Gray, 1994; Cooney, 1997) that if a fire department will (nature of jurisdiction) or may (mutual/regional aid) be involved in wildland/urban interface fires, it must train for interface operations. To ignore the issue of interface training needlessly risks the safety of structural firefighters (Swinford, 1989; Gray, 1994; Bisbee, 1994; Dunn, 1996; Cooney, 1997), and send forces to confront fires they are not trained to effectively fight (Gray, 1994; Bisbee, 1994; Cooney, 1997).

For fire departments confronting the cross-training issue, some assistance can be drawn from this research project. First, if possible, involve the local or state wildfire agency in developing policies and programs. These are the people one is likely to be working with on an interface fire, and they have both experience and access to NWCG training resources that can benefit a structural fire department. Second, use NFPA 1051 (1995) or another wildland fire training standard as the basis to redefine the job functions of the structural firefighter. If one accepts the viewpoint of Dunn (1996) or this author, the limited wildfire component of NFPA 1001 (1997) is simply not adequate. The adoption of wildfire competencies are part of the firefighter's and/or fire officer's job functions will facilitate decisions about training program adoptions and acceptance by fire personnel. Third, adopt specific

minimum training program requirements, as well as elective options. The advice, “Do as much as you can” (WFCA, 1991, p. 87) is not the model to follow. Few, if any, structural fire departments can adopt the NWCG (310-1, 1993) system. Washington/Oregon (1997) have created their system. ADOF and Mat-Su Borough have a somewhat different model. A fire department should develop or select training program requirements that allows it to prepare for its defined firefighter and/or fire officer functions during an interface fire. Fourth, be pragmatic. Whether the fire department is career, combination or volunteer, set standards that are realistic for your personnel. Fifth, if the structural fire personnel are already completing required strategy and tactics or other training that can substitute for or supplement wildland courses, insist that such training be recognized by the forestry jurisdiction. Further, insist that NFA strategic and wildland training be accepted.

The NFA’s *Introduction to Wildland and Wildland/urban Interface Firefighting for the Structural Company Officer* (1998) is a starting point if not other training is readily available. In this author’s opinion, the NFA package is insufficient. However, for the structural fire department with no wildfire training, it provides a starting point to prepare for the urban interface wildfire.

In terms of structural cross-training for wildland firefighters, this project developed an ADOF accepted training package for a pilot program. This is a starting point, but more needs to be done. Perhaps the interface curriculum being developed by the NWCG (WA/OR, 1997) will address the structure fire competencies needed by the wildland firefighter.

Cross-training is but one of three broad areas of response to the growing potential for wildland/urban interface conflagration potential. The second area of response focuses on the building of alliances with political/business leaders to marshal the support and resources to combat wildland/urban interface fires (Bailey, 1989a; Perry, 1989; FEMA, 1989; Bailey, 1990; FEMA Task Force, 1992). Funding for maintaining/increasing personnel and apparatus, mutual and interagency agreements, building code changes, and defensible space programs require political alliances. A third area of response also grows from the political alliance arena. It focuses on public education and other prevention activities as a means to reduce the potential of wildland/urban interface fire conflagration disasters (Bailey, 1889b; NFPA, 1989; FEMA, 1989; Reynolds, 1889; Fire Chief, 1990; WN&N, 1991; FEMA Task Force, 1992; Bullock, 1996).

Cross-training for fire personnel is part of the solution to the growing potential for wildland/urban interface conflagrations. Cross-training for the interface wildfire is a structural fire department responsibility—one that the executive fire officer can and must address.

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Appendix A

ALASKAN STRUCTURAL FORCES WILDLAND INTERFACE PROGRAM

DEVELOPED BY
Johnny Murdock

MATANUSKA-SUSITNA BOROUGH
FIRE SERVICES
DEPARTMENT OF PUBLIC SAFETY

1998

WITH THE
ASSISTANCE & APPROVAL OF
FIRE SAFETY & STANDARDS COMMITTEE,
ALASKA DIVISION OF FORESTRY
MAT-SU FIRE CHIEFS ASSOCIATION

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URBAN INTERFACE WILDFIRE PROGRAM

Through an agreement with Division of Forestry, the Department of Public Safety is providing wildland interface firefighting training sufficient for borough firefighters to obtain an ASFWIF-"Alaska Structural Forces" Red Card certification from State Forestry. Given the fire service's mandate to protect the public and with urban interface fires becoming more of a concern, a major goal is to get all borough fire personnel through this program. Red Card Certification occurs after the candidate passes the physical stamina test. Your FSA Chief can arrange physical testing through the Fire Training/Safety Coordinator.

MODULE I: OVERVIEW

OBJECTIVES: To develop basic competency pertaining to

1. Describing the wildland fire season in Alaska.
2. Identifying the four agencies levels with responsibility for wildland fire protection in Alaska.
3. Identifying the four wildland fire protection levels used in Alaska.
4. Identifying the types of apparatus and crews used for wildfires.
5. Defining or identifying the following terms: Single resource, Strike Team, Task Force, Leader, crew boss, squad boss & foreman.
6. Identifying four common hand tools used in wildland firefighting and listing standard hand tool safety practices.

I. The Alaska wildland fire season often begins in April with the disappearance of snow cover and the drying of exposed fuels.
   - A. South-central Alaska, including much of the Mat-Su Borough, is the location for many early season fires. These fires are typically in or near the urban interface. In late May or June, Green-up starts to reduce the hazard level.
   - B. During June through August, thunderstorm activity (especially in the interior) can result in lightning caused fires.
   - C. Human caused fires can be expected in the wildland/urban interface during any period in which the fuels are dry enough to burn.

II. Fire Organizations in Alaska: Wildland Fire Responsibilities.
   - A. Municipal Fire Department and Fire Service Areas. Responsible for fire response within their jurisdictions.
   - B. Division of Forestry (Alaska). Responsible for fire response in southern part of Alaska.
   - C. U.S. Bureau of Land Management (called Alaska Fire Service). Responsible for fire response in northern part of State.
   - D. U.S. Forest Service. Responsible for fire response in national forests (Tongass, Chugach) in Alaska.
   - E. Note: Cooperative agreements, mutual aid agreements, and the state emergency service plan provide for the pooling of resources to combat large fires and more effectively protect the public.

III. Wildfire protection standards: Within each area of Alaska, standards for wildfire protection vary as a function of the value of land/property (natural & human-made) at risk. Four options or standards are:

A. Critical protection level. Areas where wildfire presents a real & immediate threat to human safety and physical developments. Within the limitations of available resources, fires in these areas are immediately & aggressively suppressed. These fires have automatic priority over fires within the other three levels. Much of the Mat-Su Borough falls within this protection level.

B. Full protection level. For areas of high natural resource value or cultural/historical sites where there is no immediate threat to human life or habitation. Based on availability of resources, fires in these areas are also immediately and aggressively suppressed.

C. Modified protection level. Includes areas requiring full protection during critical burning periods, but less or no protection when the risk of large/damaging fires has diminished. Modified protection lands have "limited action status," except during critical burning periods.

D. Limited protection level. For areas where a natural "let burn" program is in effect or values do not warrant the expenditure of fire suppression funds. Fire suppression only if & to the extent required to keep a fire within the limited protection area. For Example, much of the northern boreal forest (interior) is part of a fire dependent ecosystem & covers 588,000 square miles.

E. Since 1960, lightning has caused 38% of the wildfires, but a total of 83% of the area lost to wildfires. In contrast, human caused fires account for 62% of the wildfires, but only 17% of the area lost to wildfires.

1. As Alaska's population increases and more homes are built in rural/forest areas, the potential for interface fires continues to grow. In a time when fire resources are shrinking or remaining (at best) static, interface fires pose a greater level of risk in terms of frequency and severity.

IV. Apparatus. **An individual piece of apparatus with its crew is called a "single resource."** Common Apparatus types are:

		Wildland Engine Types			
Components	**W-1**	**W-2**	**W-3**	**W-4**	**W-5**
Tank Cap. in gallons	751+	751+	750-401	400-150	150<
Pump GPM	150	50	50	30	10
Pump PSI Rating	250	100	100	100	100
1" Hose in feet	500	500	500	500	500
1 1/2" Hose in feet	500	500	500	500	500
Minimum Personnel	2	2	2	2	2

		Structural Engine Types		
Components	**S-1**	**S-2**	**S-3**	**S-4**
Tank Cap. in gallons	500+	500+	500+	300+
Pump GPM	1250	1000	500	300<
Ladders (NFPA 1901)	--	--	--	N/A
2 1/2" or 3" Hose-ft	800	800	800	250
1 1/2" or 1 3/4" Hose-ft	600	600	600	400
Minimum Personnel	3	3	3	2

	Structural Tender Types	
Components	**ST-1**	**ST-2**
Tank Cap. in gallons	2000+	1000+
Pump GPM	1000	500
Minimum Personnel	2	2

	Wildland (Private) Tender Types		
Components	**WT-1**	**WT-2**	**WT-3**
Tank Cap. in gallons	5000+	2500+	1000+
Pump GPM	300	200	200<
Minimum Personnel	1	1	1

A. **Strike Team: Up to five (5) of the same kind & type of resource with common communications & a leader.** Examples include a strike team of 5 engines or a strike team of 2 crews.

B. **Task Force: Up to five (5) of mixed resources with common communications & a leader.** An example would include a task force of 2 engines, 2 tenders & 1 brush apparatus. Within the Mat-Su Borough, selected resources among FSA's are assigned to Northern & Southern Task Forces. The task forces can be activated for assignments within or outside of the borough.

V. Crews. Crews are managed by a **crew boss.** For helicopters, the manager of a helitack crew/load is called a **foreman.**

A. Engine or tender crews will vary from two-to-six members.

B. Helicopter crews will vary due to the size of the helicopter or its mission, but these usually range from three-to-eight.

C. Type I Crews (3 in Alaska). Composed of 20 members, these crews have a high level of training & organization, and work seasonally on forestry and fire projects.

D. Type II Crews (73 in Alaska). Composed of 16 members, Type II crews are commonly known as emergency firefighter (EFF) crews, and work on a call-as-needed basis. In addition to the crew boss, each Type II crew will have 3 squad bosses.

E. Crew members must have a current Red Card issued through the Division of Forestry. Personnel employed by Forestry must abide by all conditions of hire.

VI. Common wildland hand tools include:

A. Two sharp hand tools.

1. **Pulaski**. A hand tool with an ax on one head & a hoe on the other head. Used for chopping, digging & grubbing in soils.
2. **Point blade shovel**. Used for digging fire line, clearing brush & throwing dirt onto a fire.
3. Safety practices for a pulaski & shovel are:
   a. Check condition of tool before using.
   b. Make sure & keep handles attached to tool heads.
   c. Handles are to be kept smooth & free from paint, oil & grease.
   d. Always keep hand tools sharp.
   e. If tool is not in use, cover head with tool guard.
   f. Always wear gloves.
   g. Carry tool on the downhill side of a slope.
   h. Carry a pulaski like a fire ax.
   i. Keep a walking distance of 6' between firefighters.
   j. Keep a working distance of 10' from other firefighters.

B. Other hand tools.

1. **Spruce bough**. A small sampling that is cut. After lower branches are removed, it is used as a broom in a sweeping motion to smother fires.
2. **Burlap bag**. Another tool used for smothering small fires. Burlap bags are more effective when wet.
3. **Swatter**. A think rubber mat with a long handle which can be used to smother fires with longer flame lengths than can be suppressed with burlap bags.

C. **Fedcos** (backpack pumps) used as portable water. Components of a fedco include 5-gallon (45 lbs. when full) collapsible water bag with harness, removable cap, hand pump & inter-changeable nozzles (spray & straight stream). Can be filled from any water source, although a filter (netting or cheesecloth) needs to be used as a filter to protect the pump from clogging with debris.
   1. A small amount (6 oz.) of Class A foam can be added to fedcos to provide wet water for greater penetration.
   2. Operation: Remember water is limited--conserve.
      a. Use spray mode to cool a wide area.
      b. Use a straight stream for flames or distance applications. Direct water at the base of the flames.
      c. Get close to be most effective

D. A **chain saw** can be used for cutting timber, brush & limbs, and to make or improve fire lines; can be used directly in cutting ground control lines.
   1. Additional required protective equipment includes leg chaps, ear protection & eye protection.
   2. Safety rules for using a chain saw are:
      a. Carry the saw at your side with the chain guard on & bar to the rear.
      b. Always wear gloves, even when sharpening.
      c. Always work with a swamper.
      d. Post a lookout when felling large trees.
      e. Clear all unnecessary personnel from the area.
      f. Never raise the chain saw above your head to cut.
      g. Always stop the engine for any maintenance.
      h. Using wedges can help avoid binding-up the saw.

E. Firing equipment.
   1. **Fusees** (also called highway flares) are used to start backfires or to burn out fuels. Safe practices include:
      a. Wear gloves (sleeves rolled down) & eye protection.
      b. Strike the cap to the fusee in a downward motion away from your face with care. Sparks can fly up into an eye.
      c. If possible, attach fusee to a 3'-to-5' pole for an easier & safer reach while igniting fuels.
      d. Be aware of wind direction. Fusee smoke is toxic.
   2. **Drip torch**. A wick-fired canister of a diesel/gasoline mixture used to quickly start fires. Safe practices include:
      a. Wear gloves with sleeves rolled down.
      b. Proper mixture is 2/3 diesel & 1/3 gasoline.
      c. Proper storage includes sealing the plug tight, lock with the ring tightly screwed-on, air vent closed, spout & wick cooled and inverted in tank.
      d. Do not light too much fire too fast. Use experienced FFs.

MODULE II: WILDLAND FIRE BEHAVIOR

OBJECTIVES: To develop basic competency sufficient to identify

1. Methods of Heat Transfer & note on Class A fires.
2. The components of the two types of wildland fire triangle.
3. The impact of weather on wildland fire spread.
4. The impact of topography on wildland fire spread.
5. The interactive effects of fuel, weather & topography on the rate of spread & intensity of a wildland fire.
6. Seven key fire behavior terms.
7. Eight parts of a wildfire.
8. The characteristics of fire behavior in the four Alaska fuel types.

Methods of Heat Transfer

I. LAW OF HEAT FLOW: Heat tends to flow from a hot to a cold substance.

II. Conduction: Heat may be conducted from one body (object) to another by direct contact of the two bodies or by an intervening heat-conducting medium.

- A. Metals are good conductors, wood is a fair conductor, liquids and gases are poor conductors. For example, a copper pipe can conduct heat (fire) from one room or level to another.
- B. Wildland. Because vegetative matter is a poor conductor of heat, this method has little effect on the spread of a wildfire.

III. Convection: The transfer of heat by the movement of air or liquid. Direct flame contact is a special case of convection.

- A. Heated air will expand and rise - convection is generally up.
- B. Wildland. Convected heat is a major source of fire spread for two reasons: (i) fuels burning on the ground can preheat and spread to fuels above (tree limbs); (ii) the preheating of fuels up slope can create a rapid fire spread uphill.

IV. Radiation: Radiated heat (heat waves) travel through air until the waves strikes an object (skin, another building, grass, trees).

- A. Structure fires. A major cause of fire spread to exposures.
- B. Wildland. The preheating of adjacent fuels (exposures) can cause a rapid fire spread.

V. Class A: Ordinary combustible materials such as wood, cloth, paper, rubber and many plastics

- A. Generally, extinguished by cooling with water. Can be extinguished by smothering, breaking chemical chain reaction, or separation of fuel.
- B. Wildland. All four methods of extinguishment are used.

Two Wildland Fire Triangles

	Standard Fire Triangle	**Environmental Fire Triangle**
A.	**Fuel**	**Fuel**
B.	**Heat**	**Weather**
C.	**Oxygen**	**Topography**

I.

1. While the standard fire triangle is one view of the combustion process, the environmental fire triangle examines the factors affecting fire intensity and rates of growth/spread.
2. Once ignited, the preheating of fuels by radiation & convection will spread a fire from its source. The components of the **environmental fire triangle** will determine a fire's intensity & rate of growth.
3. **The wildland environmental fire triangle is called, "The Big Three."**

II. Fuel. Because a wildland fire often has unlimited fuels in an unconfined space, certain fuel factors must be considered in order to effectively predict wildland fire behavior. Note: **A fuel is any material in the environment that will burn.**

A. Fuel levels. These are classified by their position on the ground or in the air.

1. Ground Fuels. All burnable material <u>beneath</u> the walking surface. Includes duff (decomposing ground litter), deep moss, roots. Fires in ground fuels are often deep seated, and their smoldering characteristics make them hard to extinguish. They can appear out, but may resurface later.
2. Surface fuels. All vegetation lying on or just above the ground. Includes needles, grass, dead logs, stumps, low brush under trees, leaves & field crops.
3. Crown fuels. They are the suspended & upright fuels. Crown fuels are physically separated from the ground & surface fuels, and are more exposed to air & wind. Crown can rapidly & intensely burn due to wind.

B. Fuel characteristics: Fuel Size.

1. Light fuels are generally flashy or fast burning. Includes dry grass, dead leaves, needles, brush & small trees. Light fuel fires spread & serve as kindling for heavier fuels.
2. Heavy fuels are larger. They are harder to ignite and initially burn slower, but once they heat-up, they will burn longer & with greater intensity than other fuels.

C. Fuel characteristics: Compactness.
   1. Compactness is the proximity of fuel particles to each other with respect to the free movement of air.
   2. Ground fuels and some surface fuels tend to be tightly compacted, and as a result may burning slowly due to a lack of oxygen. In contrast, crown fuels tend to have little compactness, and often burn very rapidly.

D. Fuel Characteristics: Loading.
   1. Fuel loading is the amount of fuel within a given area.
   2. Heavy, dense & tightly packed fuels will dry out slow & get wet slowly. Fires in these fuels are hard to start & hard to extinguish.
   3. Light, fine & loosely packed fuels will dry out fast & get wet fast. Fires in these fuels burn hot & fast when they are dry, but when they are wet fires but slowly or not at all.

E. Fuel Characteristics: Continuity or arrangement.
   1. Continuity/arrangement refers to both the horizontal & vertical spacing of fuels.
   2. Horizontal continuity. When fuels are close together, a fire will spread faster due to the effects of heat transfer. When fuels are patchy, scattered or separated by natural barriers, the heat transfer may not be enough to preheat or ignite the adjacent fuels with a resultant mosaic fire spread or even no fire spread.
   3. Vertical arrangement. When a fuel is above another burning fuel both convection & radiation contribute to preheating. This can result in rapid fire spread.
      a. **Fuel ladders** refer vertical fuel layers which result in a fire's rapid climb from surface to crown fuels. Tree limbs near the ground or brush under tree limbs can function as fuel ladders.

F. Fuel Characteristics: Fuel Moisture Content.
   1. Fuel moisture content is the amount of water in a particle when compared to its dry weight.
   2. High fuel moisture content results in fires that are hard to start & burn poorly (if at all).
   3. Low fuel moisture content results in fires that are easy to start and burn/spread rapidly.

See Watch Out Situation #11. There is unburned fuel between you and the fire.

See Watch Out Situation #17. The terrain & fuels make difficult your escape to safety zones.

III. Weather is defined as, "the condition of atmosphere over the surface of the earth." Weather can rapidly change & has the greatest effect on fire behavior. **Weather factors have caused the most wildland fire-related deaths & injuries.** The three weather factors that affect fire behavior are:

A. Air temperature. Changes daily due to energy from the sun.
   1. Warm air absorbs moisture; therefore, drying & preheating fuels resulting in fires of increased intensity.
   2. Cool air holds less moisture; therefore, fuels are damp & burn with less intensity.
   3. Temperature affects drying over long time frames to reduce moisture content levels.

B. Relative humidity. The amount of moisture in the air compared to the amount of moisture the air could hold for a given temperature.
   1. When the temperature is high, the relative humidity is usually low (afternoon). When temperature is low, the relative humidity is usually high (after midnight).
   2. When the relative humidity is high, the higher the fuel (especially lighter fuels) moisture content.

See Watch Out Situation #14. The weather is getting hotter and drier.

C. Wind is the **most important** weather factor affecting fires.
   Some different wind types are:
   1. Upslope winds are created by warn air rising due to the uneven heating of the land.
   2. Downslope winds are created by cool air descending from a higher elevation.
   3. Note: Downslope winds are generally of a slower speed than upslope winds.
   4. Thunderstorm winds. A thunderstorm starts as a rising column of moist air; convective in nature. Moisture condenses & forms clouds. If the moist air reaches an altitude where ice crystals form, a thunderstorm is the outcome.
      a. Thunderstorm winds blow down from the cloud in all directions & at high speed. Winds from 25-to-70 mph have been observed.
   5. Whirlwinds are upward spiraling vortexes that draw on new supplies of air as they move along the surface. **Fire whirls** are whirlwinds that carry fire & are fire line threats due to spotting.

D. **Winds** can **cause tremendous change** in fire behavior & the rate of fire spread. Five ways that winds can rapidly increase fire behavior are:
   1. Fanning the flames into greater intensity & supplying fresh air to speed the burning process.
   2. Evaporating fuel moisture content levels & causing an increase in fire spread.
   3. Carrying airborne sparks & embers across fire lines & causing spot fires.
   4. Angling smoke & hot air & causing more preheating from convected heat.
   5. Changing the fire direction without warning which can endanger firefighters and destroy fire control efforts.

See Watch Out Situation #4. You are unfamiliar with weather & local factors influencing fire behavior.

See Watch Out Situation #15. The wind increases or changes direction.

IV. Topography is the surface features of the earth & it has significant effects on fire behavior.
   A. Slope is the angle of terrain, and is the most important topography factor. Slope impacts both the rate & direction of fire spread. Fire will burn faster uphill than downhill. The steeper the slope, the faster a fire will move. Reasons for the effects of slope on fire are:
      1. Slope causes greater preheating of fuels.
      2. Slope creates upslope winds.
      3. Slope cause flames to bend closer to adjacent fuels.
      4. Slope can produce rolling flaming debris which can ignite downslope fuels.
   B. Aspect is the direction a slope faces, and has some impact on fire behavior.
      1. South slopes (in Northern Hemisphere) are usually hotter & drier than other slopes.
      2. Vegetation types & fuel characteristics can change with changes in aspect.
   C. Shape of the country equals the lay of the land, and affects heat transfer & weather patterns--especially wind direction & speed.
      1. Shape of country includes natural barriers (rivers, lakes), hills/mountains, and combustibility of fuels (hardwoods versus black spruce, light versus heavy fuels).
      2. Cross-canyon preheating can be caused by radiation.
      3. Inversions & drainages can affect fuel moisture content.
      4. Chimney-type land features dramatically increase the funneling of convected air.

See Watch Out Situation #2. You are working in country not previously seen in daylight.

See Watch Out Situation #9. You are building a fire line downhill with active fire below.

See Watch Out Situation #13. Your are on a hillside where rolling material can ignite the fuels below.

See Watch Out Situation #17. The terrain & fuels make your escape to safety zones difficult.

V. **Seven Key** Wildland Fire Behavior Terms.

A. **Smoldering:** A slow burning fire in ground fuels. Fire spread is slow with very little or no flames.

B. **Creeping:** A slow spreading fire in ground or surface fuels with small flames.

C. **Running:** An actively spreading fire in surface fuels with high heat & flames at the head.

D. **Torching:** A fast spreading fire moving from surface to crown fuels with high heat.

E. **Spotting:** Fires (often from embers) spreading ahead of the main fire. The spotting of numerous small fires rapidly increases overall fire spread & fire size.

F. **Crowning:** A fire spreading from tree top to tree top more or less independent of any surface fire.

G. **Blow-up:** A sudden increase in a fire's intensity & rate of spread. Often linked with violent convection, and may have other characteristics of a firestorm.

VI. Eight Parts Or Terms Used to Define a Wildfire.

A. **Perimeter:** The perimeter is the total circumference (length of the outside edge) of a burning or burned area. It is the boundary of a fire.

B. **Anchor Point:** A place to start building a control line along a fire's edge. Sometimes located at the rear or area of origin and often using a barrier, an anchor point provides some protection against the fire's flanking or moving-up from behind the crew.

C. **Tail or Rear:** The tail (heel) of a wildland fire is often located near the area of origin & is opposite the head. This is usually an area which is burning slowly. There is usually little heat, flames or smoke, and is a good anchor point location.

D. **Head:** The head is the part of the fire that is traveling or spreading most rapidly. It is the hottest part of a fire, has higher flame length,

and may be unapproachable. **Wind & Topography** are the two major factors affecting the head.

E. **Flanks:** The flanks are the sides of a wildland fire between the Head & Tail. From the tail, flanks may be labeled "Left" and "Right," or the label may be based on the compass (east & west flanks). A common method of attacking wildland fires is to pinch the head from one or both flanks.

F. **Fingers**: Fingers are narrow (sometimes long) strips of fire extending out from the main fire. Fingers may result from an area with both light and heavy fuels where the lighter fuels burn faster, or from terrain variation. Control lines are often cut between fingers & burned out.

G. **Spot Fires:** Often aided by winds, spot fires are caused by flying sparks or embers which land outside of the fire's perimeter. Spot fires must be rapidly extinguished or they are likely to form new head fires.

H. **Islands:** Unburned areas of fuel inside a fire control line that could smolder & later ignite.

VII. **Alaskan Fuels & Typical Fire Behavior.**

A. **Grasslands:** Fine & loosely compacted fuels that produce a fast-moving flash fire in the spring prior to green-up. A common fuel within interface & coastal areas.

1. A grassland fire will easily flash, but will not carry residual heat once the fire front has passed. Grass fires are surface fires which will seldom spread into a ground fire, and are not a ladder fuel.
2. After green-up, fuel moisture greatly increases and grasslands will only carry a fire under strong winds, low relative humidity or drought conditions.

B. **Tussock Tundra:** A ground fuel mat of deep lichen, moss & clump grass found in areas of interior & northern Alaska.

1. Associated fuels & issues. Surface fuels are usually fine & loosely compacted, but can moderately burn, and can burn into & through the various fuel mat layers. Tundra ground fuels are tightly compacted & will usually burn during drought conditions. Tundra is not a ladder fuel.
2. During periods of drought or when driven by strong winds, tundra fires can spread fairly rapidly. Otherwise, fire spread is at most moderate.
3. Note: **Permafrost** is frozen ground & is located at the bottom of the tundra mat.

C. **Mixed Hardwoods (birch, aspen):** In comparison to conifers (white spruce, pine), trees which are more difficult to ignite and usually burn slowly.

1. A fire's intensity will vary depending on the ratio of spruce to hardwoods. Also, the burning characteristics of hardwoods

change after green-up as a function of relative humidity & drought conditions. Except during conditions of both low humidity & drought, hardwoods are poor ladder fuels.

2. Around hardwoods, surface fuels contain leaf litter, grass, fallen branches, limbs, bark & shrubs. These fuels tend to be light & loosely packed with a few areas of compact fuels.
3. Hardwoods have often been successfully used as a firebreak to stop the spread of a wildfire. This tactic will likely fail during periods of drought.

D. **Black Spruce:** A unique northern conifer which normally contains very low fuel moisture in wood & needles, and has a very high pitch content. Ignites relatively easily, and burns with very high intensity.

1. Associated fuels & issues. Surface fuels can be tundra, grass or small bush, but tend to be light & loosely packed. Black spruce branches are excellent ladder fuels, and crowns are highly volatile.
2. Rates of fire spread are greatly impacted by wind.
3. Fires in a black spruce forest can be virtually impossible to contain or control. **Never attempt a frontal assault on a fire spreading through black spruce.**

MODULE III: PERSONAL PROTECTIVE CLOTHING FOR WILDLAND

I. Wildland Protective Clothing. Structural firefighting protective clothing is too heavy and retains too much body heat for any wildland operation of significant duration. The following list identifies proper clothing for wildland operations **(Note: Synthetic fabrics are not appropriate; cotton or other natural fiber fabrics are appropriate):**

A. Pants/Shirts. Should be forestry approved Nomex III (or other fire resistant fabric). Cotton undergarments should be worn.

B. Boots. Leather lace-up boots with 8-inch tops (minimum) and hard rubber soles. Structural turnout boots are not appropriate.

C. Helmet. OSHA approved hardhat, although fire helmet is acceptable for limited duration fires.

D. Gloves. Leather work gloves, although firefighting gloves are acceptable for limited duration fires.

E. Other PPE items include:

1. Bandannas. Used to cover the mouth when operating in woodsmoke, although stay out of smoke whenever possible.
2. Goggles. Used to protect eyes from flying debris.
3. Earplugs. Used during power saw operations.

F. Fire shelters are special tents made of heat-reflective material. A fire shelter is a last line of defense & must be available for use at all times.

II. Conditions for wearing wildland protective clothing.

III. Care and cleaning of protective clothing
   A. Stress that chemicals (combustion products & dirt) will degrade protective gear.
   B. Review SOP 91-005. Note that bleach is NEVER used to clean turnouts or wildland firefighting clothing.

MODULE IV: HOSE, FIRE STREAMS & WATER SUPPLY

OBJECTIVES: To develop basic competency pertaining to
1. Hose construction and maintenance factors
2. Hose tools & appliances and their uses
3. Forestry hose roles and couplings
4 Wildland Hose Lays, Concepts & Operations
5. Forestry nozzles
6. Fundamentals of foam operations.
7. Water Supply system components & factors

Introduction to Hose

I. Characteristics of hose
   A. Brief review of hose construction.
      1. Note that structural fire hose is double-jacketed while most forestry hose is single-jacketed.
   B. Review causes of fire hose damage & ways to prevent damage, including laying out & picking-up hose.
   C. Review methods for hose care and cleaning.
   D. Mat-Su standard structural hose: 1 ¾", 2 ½" & 3" hose.
   E. Forestry hose is 1 ½", 1" & some ¾". It is light weight.
   F. Note hose test procedures and the need to maintain accurate hose records. Hose test pressures for forestry hose are less than structural hose.

II. Review hose tools and appliances and their uses. Stress that each individual needs to become familiar with the equipment on their services' apparatus.
   A. **Wye appliances**: Both structural & light weight forestry.

   B. **Siamese appliances**: Both structural & light weight forestry (Forestry sometimes calls this appliance a "reverse wye").

   C. **Adapters/reducers**: Common are 2 ½"-to-1 ½", 1 ½"-to-1" although there are a variety of other types.

   D. **Double males & females**: Mostly 2 ½" & 1 ½"

   E. **Hydrant gates**: Often a 2 ½" X 2 ½" X 2 ½" wye.

F. **Hose clamp tool**: Both structural & light weight forestry

Hose Rolls

I. Mat-Su hose rolls
   A. Straight roll (most common forestry roll, called "single roll").
   B. Donut roll (forestry calls "double roll").

   C. Hotel/Bundle hose load. Cover/demonstrate horseshoe & accordion methods for 100' loads.
      1. Note: Forestry does use an accordion load as a hose pack.

   D. Review forestry Gansner Hose Pack & Hose Pack Sack. For wildfires, hose packs are easier to carry & deploy than hose rolls. Hose rolls are easier for storing, shipping & cleaning.

Wildland Hose Lays, Concepts & Operations

I. Forestry hose line concepts.
   A. **Working & attack** lines are used to directly work on a fire.
   B. **Supply** lines are the same a structural, although may be 1 ½".
   C. **Safety** line is one used to protect a specific area like an engine, safety zone, roof.

II. Forestry hose lays. Often involve pumping water over long distances in 1 ½" or 1" lines.
   A. **Simple hose lay.** Hoseline from pump (engine or portable pump) directly to nozzle with no junctions in between.
      1. Advantages: Quick & easy to lay with minimal friction loss.
      2. Limitations: (a) Water flow must be stopped before line can be extended; (b) No provisions for safety if the fire flares-up behind the nozzle.
   B. **Progressive hose lay (most often preferred).** Hoseline from pump which places a wye every 200' to provide for lateral lines off a main trunk line.
      1. Advantages: (a) Provides for a continuous fire attack from several locations without the need to shut-down the operation to extend any hoseline; (b) Provides a safety factor for all nozzle operators since a back-up line is always available; (c) Provides for the rapid suppression of spot fires across a control line; (d) aids with rapid & effective mop-up.
      2. Limitations: (a) slower to install; (b) produces greater friction loss in hose lay.

III. For picking-up deployed hose, forestry uses straight rolls, donut rolls, watermelon rolls & figure-8 rolls. Note: With forestry hose, Instructor should demonstrate watermelon & figure-8 rolls.

IV. Some additional wildland hose principles.
- A. When deploying hose, remember to protect the hose from hazards. Keep hose out of burned area until it is cooled.
- B. Friction loss for very long hose lays can be problem. Especially with a portable pump, pressure & volume at the end of a long lay can be greatly reduced.
  - 1. For long hose lays, start with largest diameter hose at pump, then reduce to a smaller hose (1 ½”-to-1").
- C. When a hose lay reaches the fire, always install a wye.
  - 1. Provides a location for filling Fedcos.
  - 2. Provides for a potential lateral safety line.
  - 3. Provides for lateral line operation while hoseline is being extended.
  - 4. Multiple lines expedite mop-up operations.
- D. Try to keep additional hose available at the lead nozzle. Provides for a flare-up beyond the reach of the lead nozzle, and can be used to replace a burst/damaged section of hose.

Water Supply

I. Review issues pertaining to
- A. Evaluating water sources
  - 1. Structure fires: Need larger sources capable of supplying gpm needs.
  - 2. Wildland: Small creeks, wells, even hot tubs can often supply the lower gpm requirements.
- B. Drafting (fill site) operations
- C. Supply (dump site) operations
- D. Large volume operations: Use of multiple port-a-tanks
  - 1. Cover water transfer devices and other equipment.

II. Review: Stress importance of Water Supply operations
- A. Setting-up a fold-a-tank operation. Note considerations on positioning, including need to tie-down if involved in aerial supply operation.
- B. Connecting hard suction for drafting operations
- C. Making connection for a nurse tanker operation
- D. Taking a hydrant: Dry Barrel & Dry Hydrant Operations
- E. Setting-up a portable pump draft operation.

Forestry Nozzles

Two common nozzles are used for wildland applications. Both are generally available for 1 ½" and 1" hose; both work well with the lower water volumes of wildland operations (water conservation is a wildland constant). Stream selection (straight versus fog) is the same as structural nozzles.

I. Twin-tip combination (called "Forester") nozzle. Has a combination of a straight stream tip & a fog pattern tip with shut-off. There are several straight stream tip options which can vary the size of the stream.

II. Adjustable combination (called "water waster" or "Red Head") nozzle. Stream pattern is adjustable from straight to wide-angle fog.

A Brief Classroom Review of FOAM

I. Introduce students to characteristics and types of foam
   - A. Class A Foam. Primarily used for wildland fires. Does have other applications.
   - B. Class B Foam. Used for Class B fires.
     - (1) In Mat-Su Borough, the foam used is AFFF.

II. Review type of nozzles & systems, including use of fog nozzles & aspirating attachments, and special aspirating nozzles.
   - A. Note that Compressed Air Foam systems are becoming more common around the country. There are a wide variety of CAF systems.

III. Briefly note methods of applying Class B foam
   - A. Push/roll method
   - B. Deflection/bounce method
   - C. Snow flake method

IV. Review methods of applying Class A foam
   - A. Direction attack/suppression.
   - B. Coating/protection.
   - C. Cover/extinguish.
   - D. Use as wet water.

V. **Stress the need to thoroughly clean any foam equipment and/or system after use.**

MODULE V: WILDLAND STRATEGY & TACTICS

OBJECTIVES: To develop basic competency pertaining to

1. Identifying the ten elements considered during a size-up.
2. Identifying the three tactics used for perimeter control.
3. Identifying the seven general principles of fire line construction.
4. Identifying three general methods & four specific techniques for breaking the wildland fire triangle.
5. Identifying conditions for the use of direct fire attack.
6. Identifying the three types of direct fire attack.
7. Identifying two advantages of an indirect fire attack.
8. Identifying a minimum of three methods for improving a fire line.
9. Identifying a minimum of five mop-up rules to remember.
10. Defining "gridding" as it pertains to mop-up operations.

I. Size-up. Like any size-up, a wildland size-up is an on-going process.

A. At the moment of alarm, one should be considering weather, terrain, fuels, access routes, etc. Upon arrival, the first crews must consider the critical incident factors and establish Command. Once a strategic plan is developed, Command must constantly evaluate the effectiveness of the strategy through a continuing size-up.

B. **Ten elements involved in a wildland size-up are:**

1. Estimated fire size, rate of spread, head(s) location, plus
   a. Fire behavior
   b. Flame length
2. Fuel type(s)
   a. Burning
   b. Adjacent/threatened
3. Exposures (homes, etc.)
4. Wind (direction & speed)
5. Topography
6. Water resources/sources
7. Line(s) of retreat/escape
8. Resources committed/needed
9. Plans/Strategy
10. Tactical Frequency

II. Fire Line Construction. A fire line is any control line that is used to stop a fire from advancing. A fire line may be a wet line, a hand line, a dozer line, or a retardant line.

A. Perimeter control. A goal is to establish a fire line that completely encircles the fire. All tactics used to attack a wildland fire revolve around gaining perimeter control.

1. A control line may be established at the burning edge of the fire, next to the fire, or at a considerable distance from the fire. In fact, a control line may contain elements of all three.
2. The tactics used to achieve perimeter control of a wildfire are anchoring (usually at the fire's base), flanking, and pinching off the fire's head.

B. Seven general principles for constructing fire line include:
1. Always start line at secure anchor points.
2. Either go around heavy fuel concentrations or beat the fire to them.
3. All fire lines should tie together.
4. Put lines as close to the fire as possible.
5. Use natural barriers as line.
6. Make-sure lines are wide enough to stop the fire.
7. Put burned fuels on the black side of the line; put unburned fuels on the green side of the line.

III. Breaking the fire triangle. Methods for breaking the fire triangle include:

A. Removing fuel. If the fuel in the path of a wildfire can be removed, the fire can be slowed or stopped. A fire in sparse ground fuels may be slow moving; it can be checked by constructing a fire line down to mineral soil. A fast running fire can require several fuel removal operations, including felling trees, cutting dry brush, and removing logs & low-hanging limbs. The spreading fire is stopped due to a lack of fuel in its path. Both hand lines and/or dozer lines can be can be used. Hand line construction involves:
1. The crew boss or team leader flags the fire line to be built.
2. A saw team of a sawyer & swampers takes the lead by clearing trees.
3. Crew members with hand tools follow in single file 10 feet apart to cut & dig trench.
4. When a firefighter gets too close to the next one to safely work, they call out, "**bump-up."** Firefighters in front then move up.
5. A supervisor in the rear ensures the fire line is complete and the trench is clean & wide enough.

B. Removing heat. With an adequate water supply, this is a popular method with firefighters. Heat is removed by cooling with water. Water application, wet lines and retardant lines are heat removal methods. While the use of water along a fire line can aid in quickly suppressing a wildfire, water supply may be limited and should be used wisely. When possible, always conserve water. Precautions for conserving water on a fire line include:
1. Shut-off nozzles when moving between flame areas.
2. Remember, high-pressure flows may scatter burning fuel.

3. The volume (gpm) should be kept at the lowest setting that will do an effective job.
4. Nozzles should be operated as close to the burning fuels as is practical and safe.
5. If access problems exist or develop, consider another independent water source and delivery system.

C. Removing Oxygen. In unconfined wildland fires, it is difficult to remove the supply of oxygen. Class A foam can be used to smother fire. Dirt can also be used to smother. Burlaps sacks (wet) or spruce boughs are other smothering tools.

IV. Types of Wildland Fire Attack: **Direct Attack.** Actions taken directly against the flames. These actions may cool, smother, beat out, or starve the flames of an active fire. As the term implies, the control line is constructed along & directly at the edge of the fire. This can be done with crews, engines or dozers.

A. Conditions for the use of direct attack include:
1. On small fires with less than three-foot flame lengths.
2. In lighter fuels.
3. On the flank & rear of larger fires.
4. When burning intensity, heat, smoke, and terrain will allow for this method of attack.

B. Types of direct attack:
1. Pincer. Direct attack around the fire's perimeter in opposite directions. Control may be attempted by attacking the fire from either the rear or at the head of the fire (if safe conditions permit).
2. Tandem. Direct attack along a part of the fire perimeter by resources following each other.
3. Envelopment. Attacking key or critical segments around the entire fire perimeter at approximately the same time.

See Watch Out Situation #10: You are attempting a frontal assault.

C. Direct attack considerations:
1. Monitor wind patterns. Be alert for wind shifts.
2. Take advantage of wind lulls.
3. Time the attack to coincide with fire entering into lighter fuels.
4. If removing fuels, remember green fuel should be placed in the unburned green part of the line, while blackened fuel go inside the back part of the line.

See Watch Out Situation #16: You are getting frequent spot fires across your fire line.

V. Types of Wildland Fire Attack: **Indirect Attack**. These methods are used when the fire is too hot to approach.
   A. Barriers are established to control the fire from a distance.
      1. Barriers may be natural (stream) or human created (road, fire line). Backfiring can be used to create or expand barriers.
      2. Barrier lines can be created retardant drops from aircraft or applications of Class A foam.
   B. Advantages of indirect attacks include:
      1. Less personnel exposure to heat, flames & smoke.
      2. More time to coordinate activities between the fire attack forces.

See Watch Out Situation #8. You are constructing a fire line without a safe anchor point.

See Watch Out Situation #11. There is unburned fuel between you and the fire.

See Watch Out Situation #12. You cannot see the main fire and are not in contact with anyone who can.

VI. Fire Line Improvement. Once a fire line has been constructed around the fire's perimeter, line improvement is the process of removing additional fuels & heat to strengthen the controlling edge. Some methods for making a fire line safe & secure are:
   A. Logs & wood chunks should be turned parallel with the fall line of the slop to prevent them from rolling down hill. On steeper slopes, this becomes a problem as fuels burn out.
   B. All snags, burning or unburned, close to the constructed fire line should be felled/removed as soon as possible. Snags pose a serious safety problem for personnel & equipment.
   C. Build a cup-trench, V-trench, or roll-trench to stop material from rolling down hill.
   D. Additional techniques include limbing-up fuels (removing ladder fuels), digging out roots, scattering/separating fuels, and burning out fuels.
   E. Burning out is intentionally setting fire to unburned islands of fuel inside a control line to strengthen the line.
      1. Burnout is used for direct attacks on the wildfire, and for clearing an area parallel with the control line. The control line is not complete until all fuel is burned out so that no fuel remains between the fire & control line.
      2. Fuels remaining between the main fire & fire line are burned out to insure the safety of firefighters & the security of the control lines. **Remember, "The only safe line is a black line."**

F. **Two Definitions**:
   1. Contained fire: A fire when the progress has been stopped by firefighters & other resources, but all control line are not complete.
   2. Controlled fire: A fire after crews & other resources have completely surrounded the fire & left no open line on the perimeter.

VII. Patrolling the line covers checking for spot fires & hot spots. Objective is to prevent the control line from being breached.
   A. Hike the line in teams of two with hand tools & full Fedcos.
   B. Look for spot fires (may have cooled) outside the control line.
   C. Look for gaps in the fire line.
   D. Work hot spots as a priority; working in from the outside edge.
   E. Improve areas such as wet lines that are drying out, sharp or ragged corners in the line, heavy concentrations of fuel near the line, and any areas of incomplete burnout (no black line).

VIII. **Mop-up** is the wildland parallel to structure fire overhaul. While map-up may begin as soon as the first section of control line is constructed, it is seldom assigned as a specific responsibility until the forward progress of the fire has been stopped.
   A. Mop-up is an important activity on the prevention of reburns, and involves removing burning material from along the fire control line and extinguishment of all hot areas.
      1. A **hotspot** is a small spark or flame left along a control line that can cause a fire rekindle.
      2. Tools are used to rake, chop, scrape & dig out hot fuels. Water, when available, is used to cool these fuels.
   B. Ways to find hot spots during mop-up are:
      1. By sights, including visible smoke, white ash, clouds of gnats, heat waves, steam.
      2. By smell, sniffing for smoke.
      3. By hearing, including listening for the crackling of embers or the hissing of escaping steam.
      4. By touch, called cold trailing, this is feeling with the bare hand for heat.
   C. Wet mop-up. Teams of two or more using water & hand tools.
      1. Faster & easier than dry mop-up.
      2. Conserve water only if the only water available is from backpacks.
      3. If there is water from a pump, use hose lays to deliver water.
      4. Use hand tools to mix water into hot spots. Otherwise, hot spots may not be extinguished & can rekindle.

5. A capful of Class A foam added to a Fedco increases the penetration of water.

D. Dry mop-up. Crew(s) work as a group in hot areas or split up into squads, and work with hand tools & no water.
   1. Slower & more difficult than wet mop-up.
   2. Easier when done in the cool of the day or in shade.
   3. Pulaskes chop & mix small fuel particles with cooler or frozen "real" dirt. Alaskan dirt is often not "real" dirt.
   4. Large pieces of fuel may need to be piled & burned.

E. Mop-up rules to remember include:
   1. Water delivery should be at low pressure & use of fine spray.
   2. If water is limited, don't waste water by doing jobs that can be done with hand tools.
   3. Nozzle operators should work close to the ground.
   4. Watch & smell for smoke, touch for heat, and listen for crackling embers.
   5. Roll over logs, scrape them, and wet them down.
   6. Always recheck areas that you have worked. Use flagging tape to help re-locate hot areas.
   7. Be thorough, take your time.

F. Gridding. Initial mop-up starts on the edge of the control line. Next, it progresses inward equally along all sides of the line or perimeter. Final grid mop-up is 100% mop-up of the fire or section of fire line.

G. Rehabilitation involves restoring the areas where crews & equipment have worked or camped to a natural condition as much as feasible. Replace, clean out, clean up.

MODULE VI: STRUCTURAL DEFENSE--TRIAGE DECISIONS & ACTIVITIES

OBJECTIVES: To develop basic competency pertaining to

1. Defining "Structural Triage".
2. Identifying the three structural priority categories.
3. Identifying a minimum of four factors affecting the triage decision.
4. Identifying a minimum of five power line safety rules.
5. Identifying a minimum of six rules & considerations when placing an engine during interface operations.
6. Identifying three methods/activities for reducing a structure's **exterior** ignition potential from a wildland fire.
7. Identifying three methods/activities for reducing a structure's **interior** ignition potential from a wildland fire.
8. Defining "Defensible Space," including desired clearance distance.
9. Identifying three natural fuel breaks which can aid in structural fire line construction.
10. Identifying four items located in or around many residences that may assist with site preparation & defense.

I. **Structural Triage is the prioritizing of structures that require protection from a wildfire.** The goal of triage is to maximize the impact of limited resources, and to avoid wasting resources or time.

A. Triage can be required of any firefighter during a wildfire, and threatened structures must be prioritized into one of three categories:

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

B. Triage decisions should consider the greatest potential threat based upon the worst possible scenario under the prevailing fire conditions. While crew actions may not be based on the greatest threat, the crew must have an alternative plan based on the worst case scenario.

II. Factors Affecting the Triage Decision: **Firefighter Safety & General Safety Considerations.**

A. FF Safety: **You are the most important person on the fire!**

1. Firefighters who are not physically fit to fight a wildland/urban interface fire should not be on the fire line.
2. Wear wildland firefighting clothing. The wearing of structural turnouts increases heat stress and the chances of a coronary or stroke.

B. Power lines. Downed power lines may start fires & are a common hazard during interface fires. Call the local utility for assistance. **Power line safety rules include:**

1. Be concerned at nighttime fires where a downed power line could be the fire's cause.

See Watch Out Situation #2: You are working in country not previously seen during daylight.

2. Stay clear of area(s) near wires.
3. Treat any power line in the interface as if it is charged.
4. Protect other firefighters & the public by posting a scout and by flagging off the area.
5. Don't park, fuel an apparatus, or operate heavy equipment underneath power lines.
6. Don't touch a power line with a ladder, antennae, or straight stream of water--all can conduct electricity.
7. Clear the area underneath power lines of all personnel during an aerial retardant or bucket drop operation.

C. Hazardous Materials.

1. Fuel Tanks: If possible, remove the tank(s) from the fire area, or protect the fuel tank from direct flame impingement by removing surrounding fuels or with water. Fuel lines may be the first to burn since these materials are less fire resistant. Shut-off fuel lines.
2. Pressurized vessels (propane): Compressed gas containers are designed to vent if the container exceeds a certain temperature. If this occurs, do not try to stop the venting. Try to protect the tanks from sustained heat. If feasible & safe, remove pressurized tanks away from structures.
    a. Clear fuels away from pressurized tanks to a distance adequate to protect them from excessive radiant heat OR move them to a safe area.
    b. The required safe clearance zone will depend upon fire intensity, the size & condition of the tank, and your ability to cool/shield them.
3. Toxic gases from burning structures: Such gases include polyvinyl chloride, hydrogen cyanide, phosgene, nitrogen oxides, hydrogen chloride, carbon dioxide. **Stay out of structural smoke.** These gases can rapidly cause serious and irreversible injury.
4. Toxic gases from wildfire smoke: Such cases include carbon dioxide & particulates. Whenever possible, stay upwind. Limit your exposure by staying out of the smoke as much as possible. Wearing a handkerchief across your nose & mouth will provide some limited protection.

D. Access & Egress from your operational area. Routes into the area may be limited (very narrow), over-hung by tree limbs/brush, blocked by heavy fuels, or too steep to safely drive. For engine access, egress & positioning, considerations include:

1. Structures threatened by wildfire are seldom conveniently located on wide, paved streets. Often they are off rural lanes, at the end of long/narrow driveways, and flanked (driveway and/or structure) by dense vegetation.
2. Getting into & out of a structure's area requires care and planning. Driving in may be easy, but leaving a fire in zero-visibility smoke with falling/burning trees is more challenging.
3. When approaching your work area, pay attention to landmarks & hazards. If necessary, use flagging to mark your route in & escape route(s).
4. **Back the engine into position** from the last known turn around.
5. The engine should be positioned to make it safe and convenient to work from.

6. Do not block the access for other equipment or evacuating vehicles. Park off the road if required.
7. Do not park over flammable vegetation. Scrape or burn away the fuel from the parking place if necessary.
8. Do park on the side of the structure which minimizes the engine's exposure to heat & blowing firebrands.
9. Do park the engine near (but not next to) enough to the structure to limit the length of hose lines.
10. Do not park next to or under such hazards as power lines, trees, fuel/pressurized tanks, or buildings that might burn.
11. Leave the doors closed & the windows rolled up. You don't want to find your seat on fire.

E. Pets & Livestock. Most animals that are free to move will manage to avoid being burned.
   1. If they are fenced or chained, animals need to be set free.
   2. Troublesome or frightened pets may be placed in a garage, residence, or other enclosure.

III. Factors Affecting the Triage Decision: **Structures & Exposures.** How susceptible is a given structure to fire? The size & shape of the building, its construction, its position in the lay of the land, and its defensible space will all affect the triage decision.

A. **Roof**. The roof is the most ignitable part of a structure exposed to a wildland fire.
   1. Remove any debris (leaves, grass, etc.) on the roof or in rain gutters.
   2. How fire resistant is the roofing material?
   3. Does the pitch of the roof provide for safe access/egress for firefighters?

B. **Siding on buildings**: How combustible?

C. **Heat traps**: Areas where heat & embers can funnel unto and concentrate. Examples are open gables, vents without screens or nonfire-resistant screens, overhanging decks, and awnings.
   1. Any entry of fire or firebrands into a structure will greatly increase fire control problems.
   2. Concentrate efforts on openings on the most exposed side of a structure. Openings are the less exposed side(s) may require attention, but have a lower priority.
   3. Some areas likely to require attention are:
      a. Vents & ducts which look intact. Large-mesh screens need to be covered. Employ anything that can be nailed or propped over the hole which will not easily ignite.

b. Windows should be closed & screen attached. Even if windows are intact, it is worth covering them to keep them from being broken by heat or fire or hose streams. Use plywood, sheet metal, or other flat panels.

c. Large openings such as doorways are hard to cover. Use sheets of plywood, tarps or salvage covers.

D. **Structural interior preparation includes**:

1. Close windows.
2. Remove light curtains & easily ignited materials (such as paper) from the vicinity of windows. Drapes made of synthetic materials should be drawn back or taken down.
3. Close window coverings such as natural fiber drapes, blinds, or shades.
4. Close (do not lock) interior doors to slow fire spread if fire gets inside the structure.
5. Turn-off fans, dryers or anything that blows air.
6. Turn-off fuel at the source, including fuel oil, natural gas and propane.
7. Leave-on electricity to run pumps (water wells) and provide lighting.
   a. If the structure's interior becomes involved in fire, immediately turn-off electricity for safety.
8. Leave-on a porch light & central interior lighting to provide visibility during dark or smoky conditions.
   a. Patrolling engines will more easily see a house and its condition.
   b. Firefighters needing to enter the structure will have visibility.
9. Leave exterior doors unlocked. This aids firefighters if an interior attack is later required.

IV. Factors Affecting the Triage Decision: **Fuels Surrounding the Structure Site**, including fuels that can produce spot fires.

A. Yard Accumulation. Are there items such as vehicles, pipes, poles, woodpiles, wooden fences, fuel tanks, etc. around the structure/yard which create hazards or fire control problems? Are some or all of these items worth protecting?

1. Yard accumulation can interfere with the placement & movement of hoselines, complicate burnout (firing) operations, or provide a fire path to a structure.
2. If feasible, remove yard fuels to a protected location or to a location where their loss will not threaten the structure.
3. Break the contact of items such as fences & woodpiles with the structure. If time allows, scatter a woodpile well away from the structure.

4. For objects that cannot be moved, clearout or burnout these objects.

B. Vehicles left in a yard can pose a risk to personnel and structures. To the extent possible,
   1. Park such vehicles in a sheltered location away from heat & firebrands.
   2. Park such vehicles away from any structures.
   3. Make sure such vehicles do not interfere with the access & egress of apparatus or the movement of fire equipment.
   4. Do not park vehicles over vegetation that could burn.
   5. Park the vehicle headed out with the keys in the ignition.
   6. Close windows/doors, but do not lock the vehicle.

C. Defensible Space. The desired clearance surrounding a structure or group of structures that will inhibit fire spread equals defensible space. The desired width of this space will vary as a function of the intensity of the wildfire & available fuels. As a general rule, the desired clearance is (a minimum) **two-to-three times the length of the flames.**
   1. Sufficient clearance is required to allow firefighters to safely operate around the structure. If steep slopes or strong winds will drive the fire hard toward the structure, then the width of the defensible space must be significantly increased.
   2. Removing & Trimming fuels. Vegetation likely to burn must be cleared from the zone around the structure. To provide a cleared zone of two-to-three times the flame length, the vegetation which could produce these flames must be removed or broken-up. Vegetation that would produce shorter flames requires a smaller clearance. Therefore, relatively short grass will require less clearance than brush or timber. **Remove ladder fuels.**
   3. Place cleared vegetation where it will not burn, or where it will not cause a problem if it does burn. Simply felling trees or cutting-off branches and then leaving them lay is likely to create a more dangerous fuel bed.

V. Factors Affecting the Triage Decision: **Fire Behavior & Fire Line Construction.**

A. Fire Behavior Predictions. Will fire entering the defensive area smolder, creep, run, torch, spot, crown, or blow-up?
   1. Rate of Spread: Where is the head of the fire? Is there spotting or firebrands? What are the flame lengths? Is smoke hampering visibility?
   2. Topographic Influence: What is the lay of the surrounding land? How will this influence fire intensity and behavior?
   3. Weather Influence: What are the winds, temperature, and relative humidity?

B. Fire Line Construction.
   1. Fire line should be should be placed in fuels/terrain where the main fire or backfiring operations can be controlled.
   2. It should be placed as close as feasible to a nonflammable zone (lawn, driveway) or to the structure. If flammable vegetation or other materials that could carry the fire to the structure remains inside the control line, firebrands can ignite these items and then reach the structure.
   3. The **primary control line** may need to be placed well away from a structure to handle the main fire. If fuels surrounding the structure remain a concern, a secondary firing operation may be required to clean-up these fuels. In some instances, a **secondary control line** will be required close to the structure.
   4. In planning the fire line(s), take advantage of existing natural breaks in the fuels. These include:
      a. Roads & driveways
      b. Lawns & landscaped areas
      c. Driven-on & trampled grass areas
      d. Power line right-of-ways
      e. Trails & paths

C. On-site resources. Look for items on-site that can be used to help prepare the structure and fight the fire. Consider:
   1. Building materials for covering openings in the structure (plywood, boards, sheet metal, tarps, etc.).
   2. Hammers, saws, nails, wire for securing coverings.
   3. Use rakes, brooms & blowers to remove leaves, needles, or grass.
   4. Ladders. Use on-site residential ladders if possible. Position them for easy/safe rood access. Some home extension ladders can be taken apart to provide separate ladders. The extra ladder section may be used to access an upper roof, another building, or as a secondary ladder for the same roof. When placing a ladder, try to accomplish the following:
      a. Place it on an unexposed part of the building away from the worst heat/smoke. It should be usable when the fire arrives at the structure.
      b. Leave it visible so that other firefighters who come along & need quick roof access will see it.
      c. Minimize the distance a hose line would be laid from an engine to access the roof.

MODULE VII: STRUCTURAL DEFENSE--INTERFACE FIRE OPERATIONS

OBJECTIVES: To develop basic competency pertaining to

1. Identifying the types/classifications of hoselines placed around a structure.
2. Defining reasons for prelaying hoselines.
3. Defining Peak Heat wave and how varying types of fuel may impact its duration.
4. Three locations on or around a structure where the application of Class A foam would be beneficial.
5. Identifying the four general situations likely to be faced when confronting a fire at a structure.
6. Identifying four situations that may mean the fire situation at a structure is hopeless.

I. The interface fire operations as discussed in this section apply when a crew/engine is committed to one structure and when it remains mobile. The tactics reviewed here apply to urban interface fires, to village protection, to protecting a cabin. Although the water sources & water supply may change, the placement of hose and Strategy/Tactics will remain essentially the same.

II. Hoseline Placement Around Structures. The hoselines & nozzles employed must be large enough to handle the anticipated fire intensity. Conversely, the hoselines & flow rates cannot be so large that the water supply is rapidly exhausted. The hoselines deployed or readily available must be adequate to protect the structure, including the roof, **yet leave a safety line for the engine.**

A. Working Lines.

1. The preferred choice for the main working line is a 1 ½" or 1 ¾" hose. Each hose size will provide an adequate fire stream while being reasonably easy to handle & move.
   a. Hoselines of 1" and ¾" provide for even greater mobility & ease of operation **if** the reduced flow can handle the highest anticipated fire intensity.
   b. Booster (hard) lines are generally not deployed. The reason is that such lines cannot be rapidly cut-off & abandoned without damage.
2. **Deploy a minimum of two working lines**, one around each side of a structure or around a pair of adjacent structures. While lines must be long enough to meet behind the structures, lines should usually be no longer than 200 feet (note: Engine placement is critical). Lines deployed in this fashion allow:
   a. Two fire streams to be directed at hot-spots or flare-ups.
   b. A back-up line if one line fails.
   c. A fire front to be split-up & directed around the sides of a structure or structures.

3. The lines should be attached to the same side of the engine & to outlets that have a shut-off valve at the engine. This allows the lines to be rapidly disconnected if a retreat is necessary.
4. Deploy the hoselines behind the engine & not in its exit path. If the engine must leave in a hurry, one does not want to risk wrapping hoselines around a wheel.

B. Supplementary Lines.
1. Hoselines must be readily available for use on the roof or in the structure's interior. Such lines can be:
   a. Stretched to a ladder.
   b. Stretched to an entry door.
   c. Left on or near the engine, yet ready for rapid deployment.
2. A hoseline ready for interior use must be 1 ½" or 1 ¾". It must be equipped with an appropriate nozzle and supplied by a pump sufficient to produce sustained 100 gpm flows.
3. A roof line can be a 1" hose or even a garden hose. These lines can handle small spot fires. If the roof becomes well involved in fire, a 1 ½" line minimum will be required.
4. Any hoseline positioned for immediate use should be charged & checked.

C. Engine Safety Line.
1. One hoseline must be provided for the protection of the engine & crew. This line may be needed if fire overruns the location or if the engine must drive out through the fire.
2. Engine Safety Line Requirements:
   a. Hose length must be sufficient to reach around the engine.
   b. It should be connected to a discharge port.
   c. It may be loosely coiled or laid on top of the engine or hose bed. It must be easy to access for rapid deployment & charging.
   d. Make sure it will not fall off the engine while it is in motion.

D. Prelaid lines. In some cases, hoselines can be prelaid a crew (e.g., one with hose packs), a hose truck, or engine. Later, as a fire approaches, an engine or pump is placed to supply the prelaid lines.
1. Prelaid lines should be left so that they are easily seen by an incoming engine.
2. Leave sufficient slack or looped hose so that couplings can be easily connected to discharge ports.
3. Do not leave couplings where they might be run over by an incoming vehicle.
4. Prelaid lines can be marked with flagging, or the ends may be draped over a fence, mailbox, limb, or bush.

III. Techniques of water use. The wise use of water is critical to the success of structural defense efforts. Water is often in short supply during interface fires. Rural water systems are usually low capacity or nonexistent. Even good water supply systems are not designed to handle the numerous fire needs of an interface fire. **All too often power failures shut down water system pumps, including residential wells.**

A. Water supplies.

1. Save a 100-gallon reserve in the engine. This water is an emergency reserve to protect the engine & crew.
2. Take advantage of any opportunity to add water to the engine's tank. Run a garden hose into the tank while parked at a structure.
3. Know the locations of any fill-sites in the area. Know if there is or is not tender support.

B. **Peak Heat Wave Tactics.** The passing front of a wildland fire can be compared to a wave of heat. As the wildfire approaches, heat & firebrands will increase. During the peak of heat/smoke, it is very tempting to squirt water at the wall of flame in the hope that it will somehow improve things. But wetting down fuels & the structure prior to an oncoming fire **is usually a waste of time & water.** In the face of high winds, low humidity & fire, wetted surfaces will rapidly dry out and become susceptible to ignition. **Water is more effectively used on actual fire when it can significantly reduce heat or extinguish burning fuels.**

1. Escaping radiant heat. Seek refuge behind something that blocks the heat. Duck behind a wall, stay below the roof peak on the sheltered side, or get behind some object.

C. The **duration of peak wave heat** depends on the fuels involved & the overall burning conditions.

1. In light fuels such as grass, the flame front will pass a given location in a minute or so. A wildland fire will generally move past a structure in no more than a few minutes.
2. In brush or medium type fuels, burnout times are longer and spread rates are often lower than for grass under similar conditions. The fire can take 10-to-15 minutes to move past a structure.
3. Crown fires in timber can generate intense heat that may last a considerable time at any location.
4. Whatever the fuel, if the fire is burning sporadically, the duration of the heat wave near a structure will be prolonged. However, the peak heat intensity will be less given the slower rate of fuel consumption.

IV. Class A Foam Use. One method of water application **suitable for pretreating structures** is Class A foam. When foam is correctly applied & built-up on wildland fuels (including structures), it both insulates the fuel from the fire's heat & prevents the release of flammable vapors.

A. Class A foam can be applied to fuel tanks & pressurized containers. Foam clinging to the sides of these vessels will cool them, protection them from radiant heat, and provide some protection from direct flame contact.

1. If flammable liquids or other hazardous materials become involved in fire, vacate the area & report the situation. Firefighters trained to handle that hazardous material will be required to address the situation.

B. Class A foam is excellent for coating roofs & other structural areas likely to ignite.

C. Class A foam can be used to build or improve a fire line around a structure.

D. Class A foam should not be confused with Class B (hydrocarbon) foam. **Do not** use Class A foam on flammable liquid (Class B) fires.

V. Confronting a fire at a structure. Review the following four general situations. Always remember that the situation may change during the course of a fire.

A. Full containment around a structure. Cut-off the fire before it reaches the buildings, essentially at the outer edge of the yard.

1. Use water and/or hand tools. Alternative, let it burn into a fuel break.
2. Such fires may be burning in light fuels, and not hard driven by wind or slope.
3. If one cannot wait for the main fire or if the fire will be too intense for direct control, consider burning out from a control line.

B. Partial containment around a structure. If it appears that only partial containment is possible, try to modify or reduce the fire as it hits. Recognize that the fire will move past the structure(s) before a control line can be fully established.

1. Use working lines to knock down that segment of the fire front moving directly toward a structure.
2. If possible, burn out from a short section of the control line to take out the most threatening segment of the fire front.
3. Once you have split the fire front, use the working lines to lead the fire on around the structure.
4. After passage of the fire front, put out any fires remaining along the fringes.
5. Thoroughly check the structure for fire. Remember the common ignition points.

C. Spotting zone & firebrands. Firebrands are a major problem in the spotting zone. The main fire may move through later (creating a different situation), or it may never arrive. The threat from firebrands may exist for several hours.
   1. Firebrands may ignite new (spot) fires a mile or more ahead of the main fire.
      a. Retain enough mobility to quickly reach any point within the crew's area of responsibility.
      b. Hose line deployments may not be necessary except to actually put out a spot fire. Consider prelaid hoselines in critical areas. It is faster to connect to prelaid lines than to deploy off of the engine.
   2. Constantly check for new ignitions. Never relax vigilance while firebrands are spotting.
      a. Watch prime receptive fuels such as roofs, decks, and woodpiles.
      b. Patrol as necessary, and post lookouts with radios.
   3. If a spot fire occurs, attack it quickly. Make sure it is completely out or has an adequate control line so that the fire cannot spread. **Remain alert for other spot fires occurring at the same time.**

D. No containment around a structure. If no containment is possible, and the wildland fire will move through essentially unchecked, **efforts will have to be directed at the structure.**
   1. Direct all hoselines onto the structure & allow the fire to burn past.
   2. If the fire's intensity threatens crew safety, retreat to a safe zone & re-enter the area once the fire has past. **An engine crew's protected defensive space is most likely the safest area. Any attempt to retreat out of this protected defensive space is likely to be obstructed by fire.**
      a. Once the fire has passed, an immediate check of structures is required.

E. **Review:** When a fire is controllable, limit the heat build-up by keeping the fire out of heavier fuels. Work on the fire where it has moved into lighter fuels. **At the other extreme**, wait until the worst of the heat has passed, then put water on the structure or threatened fuels. In between these extremes, **apply water only if it significantly reduces the heat impinging on the structure.** Conserve water during structural defense by:
   1. Applying water directly on the fire.
   2. Using Class A foam if possible.
   3. Refill the engine's water tank whenever possible.

VI. When is it Hopeless? No simple rule will determine when to attempt to save or when to abandon a structural defense effort. **Never forget that firefighter safety is the first priority.** If any of the following conditions exist, any attempt to save a structure deserves careful consideration before continuing:

A. The fire is making significant runs (no just isolated flare-ups) in the larger fuels (brush or tree crowns). The structure is within one or two flame lengths of those fuels.

B. Spot fires are igniting on & around the structure & growing faster than they can be put out with the resources on-site.

C. A lack of water will not allow the firefighting efforts to continue until the threat subsides.

D. The crew/engine cannot safely remain at the structure and the escape route is likely to become blocked by fire, traffic, falling trees, or rolling obstacles.

E. The roof is more than one-quarter involved with fire, windy conditions exist, and other adjacent structures are threatened or involved.

F. Interior rooms are involved & windows are broken.

G. If fire conditions change or if the battle is being lost, rethink the plan. **Remember, the triage decision can change as fire conditions change.** Do not waste resources on a lost cause.

MODULE VIII: WILDLAND FIREFIGHTER SAFETY & SURVIVAL

OBJECTIVES: To develop basic competency pertaining to

1. Identifying five safe practices to use around helicopter operations.
2. Identifying the ten standard firefighting orders.
3. Identifying the eighteen-wildland **fire watch out** situations.
4. Identifying the four common denominators of many fatal and near-fatal incidents on wildland/interface fires.
5. Identifying components of L-C-E-S.
6. Identifying the fifteen **watch out situations** involving wildland/structural **interface fires.**
7. Identifying **engine survival techniques** if trapped in an interface fire.
8. Identifying rescue/evacuation procedures for assisting the public during an interface fire.
9. Identifying five procedures involved in successfully **deploying a fire shelter**.

I. **Aircraft Safety.** Wildland fire operations heavily rely on aircraft support. Rotor & fixed-wing aircraft provide firefighter transport, water & retardant delivery, aerial backfiring, supply, reconnaissance and communication support.

A. **Helicopters Operations.** Helicopters are commonly used for point-to-point delivery on wildland fires. Sizes vary from small, to medium, to large. The larger the helicopter, the more wind it creates.

1. **Proper boarding & exiting procedures.** Safe areas to walk on & off helicopters are to the front & sides of the aircraft where the pilot can see you, and **always stay away from the tail rotor.**
2. Proper distance. **Stay a minimum of 60 feet away from a helicopter approaching to land.**
   a. Be aware that as the helicopter approaches, a cushion of air is generated by the rotors that can exceed 50 mph. **Wear eye protection.**
   b. Light objects not tied down will blow away or be sucked into the rotors. Be sure to properly weight down or tie down light objects.
   c. **Nearby hot areas can furiously ignite.** Fires can escape control lines due to rotor winds.
   d. Decibels will exceed all safe noise levels & inhibit all normal conversation. **Wear appropriate ear protection.**
   e. Plan for an approaching helicopter by establishing good communication with the pilot & all ground personnel **before** it arrives at the location.
3. Personal Protective Equipment necessary to fly on fire related duties include:
   a. Hard hat with chin strap.
   b. Gloves
   c. Nomex shirt
   d. Nomex pants
   e. Earplugs
   f. Boots
4. **No smoking** is allowed on helicopters or around fueling operations.
5. Side-hill approaches. When a helicopter is sitting on an uneven pad or side-hill, approach & exit in a full crouch & from the downhill side. Keep low & aware of rotor height.
6. Pitot Tube. This tube protrudes off the nose of the aircraft. It is part of the air speed indicator and contains an electronically controlled heating element. **Do not** touch the pitot tube since it can cause severe burns. Take care to avoid walking into the tube.
7. Carrying Tools. Carry tools flat & low. A tool carried over the shoulder might strike the rotor system. Never throw anything near the main rotor since it can be sucked into the blades & quickly thrown down in any direction.

8. Loading Considerations. Air operations personnel should direct all loading. Tools must be loaded in proper balance & secured within the cargo area. Never place sharp tools under seats or within the passenger cabin.
9. In-flight safety. Aviation personnel should provide a briefing before any flight. Standard operating procedures include use of safety belts, no smoking, emergency exit procedures, as well as the location fire extinguisher, survival equipment & emergency locator transmitter.
10. Tail rotor avoidance. Never approach a helicopter from the rear. Whirling rotors are invisible & deadly.
11. Helicopter Bucket Use. A valuable & effective firefighting tool is the delivery of water from a helicopter bucket. The bucket is attached to the helicopter by a steel cable. The pilot controls the operation of the bucket, including water drops. **Safety considerations around a drop zone include:**
    a. Keep all personnel clear of the drop area.
    b. Be aware of rotor wash & how it can affect the fire.
    c. Remember that buckets can separate from the helicopter.

B. **Fixed-wing aircraft.**

1. Propellers. Fixed-wing aircraft have propellers that are like rotors in their ability to create an airfoil. Most fixed-wing aircraft have propellers located in the front, near to the ground. Never approach propellers from the front. Maintain caution & safety awareness at all times.
2. Retardant Drops. Chemicals and foam agents are mixed with large amounts of water to form a retardant mixture (sometimes called, "Slurry"). Retardant is delivered to a fire by large cargo planes at low altitudes (100-to-1000 feet above ground level) and at significant speeds (100-to-200 mph). **Extensive damage** from the force of liquid impact **will occur** within the drop zone.
    a. Be aware when & where a retardant aircraft will be working in the area. Stay clear & warn others to stay clear.
    b. Be aware of the potential for wind gusts arising from low flying aircraft & what the wind can potentially do to the fire.
    c. Be aware of all improvements, including power lines. Stay well away from power lines.

d. If you are in the path of a retardant drop, discard all light objects (including hand tools), and **lie down facing the aircraft with hands over your helmet.** Do not remain in a standing position. Do not hide in apparatus. Do not hide behind trees, smaller apparatus, or small structures. One can use large apparatus or strong structures as shields.

II. Heavy Equipment Safety. Heavy equipment includes earth-moving vehicles, large water tenders, or other large vehicles.

A. The loud noise levels such machines produce often makes communication difficult. Foreman or line locators can help in coordinating communication.

B. **Yield to tonnage.** Give heavy equipment lots of room. The larger the machinery, the farther firefighters should operate from it.

III. Wildland firefighters continue to suffer serious injuries & fatalities that are preventable. The Standing Fire Orders define proper actions.

A. **F**ight fire aggressively, but provide for safety first.
B. **I**nitiate all actions on current & expected behavior of the fire.
C. **R**ecognize current weather conditions & obtain forecasts.
D. **E**nsure instructions are given & understood.
E. **O**btain current information on fire's status.
F. **R**emain in communication with your crew, your boss & adjacent forces.
G. **D**etermine safety zones & escape routes.
H. **E**stablish lookouts when there is possible danger.
I. **R**etain control at all times.
K. **S**tay alert, keep calm, think clearly, act decisively

IV. **Wildland** Fire Situations that Shout "**Watch-Out."** The 18 Watch Out situations are intended to emphasize avoiding situations and conditions that have resulted in fire shelter deployments, serious injuries, and fatalities.

A. Fire is not scouted or sized-up (#1)
   1. Communicate with other engine crews & line personnel.
   2. Keep your crew together.
   3. Be aware of escape routes & safety zones.

B. You are working in country not previously seen in daylight (#2).
   1. Hazards increase in nighttime due to poor visibility.
   2. Maintain good communication.
   3. Wear a headlamp if venturing into darkness.

C. The safety zones & escape routes are not identified (#3).
   1. Always be aware of their location, especially if burning conditions change. Ask your crew boss, foreman or strike team leader if in question.

D. You are unfamiliar with weather & local factors influencing fire behavior (#4).
   1. Keep alert for changes in wind speed & direction, and inform everyone if you notice something different.

E. You are uninformed on strategy, tactics & hazards (#5).
   1. Ask questions of other firefighters & supervisors. Obtain a briefing from your supervisor. On project fires, know Incident Action Plan.

F. The instructions & assignment(s) are not clear (#6).
   1. Ask for explanation if the assignment does not seem to relate to the strategy & tactics.

G. There is no communications link between crew members & the supervisor (#7).
   1. Keep in constant communication with other firefighters working as a team or crew.
   2. Let someone know where you are going if you are going to take independent action.

H. You are constructing a fire line without a safe anchor point (#8).
   1. Scout the fire line behind & ahead of your crew. Check behind for rekindling. Check the fire ahead to anticipate fire behavior. Be sure the fire has not spotted across the line & that spot fires have not cut-off other firefighters.
   2. Start the fire line at a natural barrier, a road, or in light fuels that can be burned out.

I. You are building a fire line downhill with active fire below (#9).
   1. This is a dangerous situation because of the probability of convective heat blow-up. Know the location of escape routes & safety zones. If building fire line downhill, place scouts to constantly monitor the fire behavior & the weather factors that could change the fire behavior.
   2. Expect & look for spot fires. Be aware of rolling rocks & logs.

J. You are attempting a frontal assault on a fire (#10).
   1. Do not attempt to take on more fire & smoke than you can handle. If this is being attempted with apparatus, make sure there is plenty of water.
   2. Keep your crew together, and do not get cut-off from your escape route.
   3. Take immediate action on all spot fires over the line.
   4. Maintain good communication.

K. There is unburned fuel between you & the fire (#11).
   1. Stay alert for crowning & spotting.
   2. Know the location of escape routes & safety zones.
   3. Stay in voice or eye contact with supervisors.
   4. Consider burning out.

L. You cannot see the main fire, and are not in contact with anyone who can see it (#12).
   1. Keep good communication with nearby firefighters.
   2. Post lookouts.

M. You are on a hillside where rolling materials can ignite the fuels below (#13).
   1. You can easily be trapped between the main fire & spot fires below. Make sure the line behind you is patrolled.
   2. Keep aware of safety zones. Move into a burned section if no other safety zones is available.
   3. Dig cup trenches that will hold rolling logs, and turn logs so they will not roll down slope.

N. The weather is getting hotter & drier (#14).
   1. Be alert for increased fire spread & longer flame lengths.
   2. Expect more spot fires & increased heat along the fire line. Make sure spot fires & current section of line are out before leaving them.
   3. Know the escape routes of the fire blows-up.
   4. Make sure you have enough drinking water.
   5. Use fire suppression water wisely.

O. The wind increases or changes in direction (#15).
   1. Be alert for increased fire spread & longer flame lengths.
   2. Make sure you can see the fire or post scouts who can see it. Look for increased spotting, firebrands, smoke, or other indicators of strong, shifting winds. Be aware of convective thunderheads.

P. You are getting frequent spot fires across your fire line (#16).
   1. Do not become trapped between two fires. Know the escape routes & safe zones.
   2. Take immediate actions to suppress these new fires. Request help if necessary. Communicate the situation to adjacent forces and supervisors.

Q. The terrain & fuels make escape to safety zones difficult (#17).
   1. Know where the fire & safety zones are at all times. If the safety zone is threatened, consider immediate evacuation.

R. You feel like taking a nap near the fire line (#18).
   1. Fatigue is a reality. When a crew stops for a break near a fire line, a lookout should be posted.

V. **Fatal & Near-Fatal Fires.** Similarities have been isolated by evaluating past fire tragedies. By being aware of several common denominators, firefighters can identify potential deadly situations and take appropriate steps to insure their survival. The **four** common denominators of fatal & near-fatal fires are:

A. At relatively small fires or within relatively quiet areas of large fires. Often firefighters become careless or fail to pay attention to changing conditions.
B. At fires involving relatively light fuels such as grass or light brush.
C. At fires where there has been an unexpected shift in wind direction and/or wind speed.
D. At fires where the fire responds to topographical conditions and runs uphill.

VI. **Always utilize L-C-E-S: Lookouts-Communications-Escape Routes-Safety Zones.** Supervisory personnel (crew bosses, task force leaders, division/group supervisors) should use L-C-E-S during any deployment or operation.

A. Lookout(s). When a fire or its behavior is not directly observable from a work area, a lookout should be posted to monitor the fire or its approach. Fire behavior changes which pose a threat to a crew or work area must be observed if proper tactics or precautions are to be employed.
B. Communications. Up the chain-of-command or down the chain-of-command, messages must be received and/or replayed to all affected personnel. For example, no member of a crew or task force should be out of the communication loop.
C. Escape route(s). When moving into an area, one or more escape routes must be identified and made know to all personnel. One lookout function
is to monitor a fire's behavior in terms of escape route threat. Personnel
should not remain in an area if the escape route is threatened.
D. Safety zone(s). Safe areas must be identified and communicated to all personnel.

VII. **Structural** Fire Situations that Shout "**Watch-Out."** The 15 additional Watch Out situations during an interface fire are:

A. Structures which are of wood construction with shake shingle roofs.
B. Access is poor. For example, trees & other fuels next to the driveway are likely to block escape.
C. There are inadequate water supplies to attack the fire.
D. Natural fuels are within 30 feet of the structure(s).
E. There are strong winds, and the fire behavior is erratic.
F. Structures are located within a chimney or canyon situation.
G. There are panicked people in the vicinity.
H. Structure(s) have open crawl spaces (or decks) and contain added fuels under the structure(s).
I. Bridges in the vicinity are narrow, or have light or unknown load limits.
J. There are propane or elevated fuel tanks present.

K. There are septic tanks & leach lines.
L. There are garages with closed & locked doors.
M. The structure is burning with puffing smoke emissions.
N. Windows of the structure are black with smoke.
O. Windows of the structure are bulging.

VIII. **Survival Techniques if Trapped By an Interface Fire.** Several of the survival techniques listed in this section regarding the taking of refuge in a structure or vehicle can also be used with rescue & evacuation procedures involving the public.

A. Take refuge in a structure if it will not initially (instantly) burn & will provide temporary protection from a wildfire.
   1. While the roof & other exterior areas may ignite, the interior can provide a temporary safety zone during the fire's peak heat wave at the location.
   2. Light structures such as mobile homes, sheds, and many modular homes ignite & burn rapidly. These structures should not be considered as a protected location.

B. Take refuge in an engine. Find a safe location & stay with the apparatus.
   1. Do not park the apparatus over fuels that will burn. Consider a burn out operation around the engine.
   2. Park the engine away from heavy fuels since this will improve the chances of survival. Metal gas tanks & containers rarely explode.
   3. Keep the pump running & use the looped 1 1/2" line to deploy a fog pattern over the cab.
   4. Take self-contained breathing apparatus (if available) into the cab & use as necessary to avoid breathing smoke.
   5. Use fire shelters, coats, blankets or salvage covers to cover windows (from the inside) to block radiant heat.
   6. Roll-up windows & close vents.
   7. Request air support for retardant or water bucket drops.
   8. If the temperature rises, cover your face with a dry cloth.
   9. Stay inside the cab until it is safe to go outside.
      a. If the motor has died, realize there is not enough oxygen outside to support your life.
      b. If the engine is catching on fire, so will you if you go outside.
      c. Get on the floor. The cab will normally burn last, any may buy enough time until the outside starts to cool down.

IX. **Rescue & Evacuation Procedures in the Interface.** Requirements moving people to safety are **sufficient time** to complete the evacuation and a **safe location** locate them. If there is neither time nor a safe location, consider leaving people in their homes until the firestorm passes. Rescue can be a choice of either removing the fire from the victims or removing the victims from the fire (or a combination of both). Request evacuation assistance from law enforcement authorities. Firefighters can help with rescue through the following:

A. Assist those who are evacuating on their own.
B. Evacuate those who are nearest to the fire.
C. Evacuate area(s) ahead of the fire.
D. Try to move persons trapped into an area where they can be protected from radiant heat.
E. Move persons who are in an open area to a location where there is the least amount of combustibles. Consider a burn out operation to provide a larger cleared area.

X. **Fire Shelters.** A wildland firefighter **must** carry a fire shelter as part of their **Personal Protective Equipment.** It is used as the **last line** of defense.

A. Design & Deployment. The fire shelter was designed in the early 1970's to reduce fire exposure & radiant heat. It is constructed of commercial grade aluminum foil over fiberglass cloth bonded by a nontoxic adhesive capable of withstanding 1,400 degrees F.
   1. When selecting a deployment location, remember:
      a. A fire shelter is most effective in light fuel types where thermal outputs are low & rates of spread are high.
      b. Heavy fuels or equipment next to a shelter will burn with temperatures exceeding 1,400 degrees.
      c. Remove as many fuels as possible from the area of deployment--minimum of 4' X 8'.
      d. Scrape fuels down to be mineral soil beneath the shelter
      e. Avoid areas of heavy fuels where crowning fire behavior could occur.
   2. The fire shelter's shape resembles a low-profile pup tent with interior straps.
      a. These straps allow a firefighter to physically hold down the shelter during windy conditions.
      b. The shelter forms an air trap to take advantage of cooler temperatures near the ground.
   3. Avoid deployments in areas such as ridgelines or in saddles. The turbulent winds & thermal outputs common to these areas in a fire are likely to exceed a firefighter's ability to hold down a shelter & survive.

4. Deploy a shelter with feet toward an on-coming fire.
   a. The shelter's aluminum skin may get very hot, so attempt to hold it away from the body.
   b. Expect tremendous noise & wind turbulence as a fire approaches.
5. Do not take hand tools or other equipment inside the shelter. Do not leave chain saws, fusees or fueled equipment next to shelter deployment areas.

B. Inside a shelter, the firefighter should be wearing fire resistant clothing, hard hat & gloves.
   1. Communicate with others by loud talking or radio. This can provide needed moral support.
   2. Resist breathing into a wet cloth since moist hot air will only increase lung damage. A dry cloth over one's face with short & shallow breaths next to the ground is best.
   3. **Drink as much water as possible.** Do not drink excessively hot water. While a goal is to stay hydrated, one must also protect the airway & lungs from heat.

C. Once inside a shelter, the temperature may reach 150+ degrees F during a peak heat wave.
   1. Resist panic. Firefighters can & have survived these temperatures during burn-overs.
   2. Plan on several thermal impulses. Do not leave the shelter too early. Many successful deployments have lasted around an hour.
   3. By occasionally lifting up one corner, one can keep a shelter relatively free of smoke.
   4. If movement becomes necessary, while wearing gloves stand-up in the shelter, deflect heat with the shelter, and move to a cooler position. **This is a last ditch effort & is likely to fail.**

D. **The procedures for successful shelter deployment can be summarized as:**
   1. Select a safety zone with mineral soil or light fuels.
   2. Clear an are 4' X 8' minimum.
   3. Open case, unfold & shake out the fire shelter.
   4. Dispose of tools & equipment. Chain saws, etc. must be placed well outside the shelter safety zone.
   5. Enter the shelter with feet toward the fire.

E. A note on cuts & tears in a shelter. If these happen during a deployment, do not panic or get too concerned. Although more heat & smoke will enter the shelter, it will still provide enough thermal protection to survive most heat waves.

F. Shelter Maintenance & Storage. Two cases protect the skin of a shelter from cracks, tears and abrasions.
   1. A clear, sealed plastic envelope surrounds the foil shelter & permits a visual inspection of the shelter, its folds, and manufacturer's label while sealing out dust & other elements.
   2. The plastic envelope fits snugly into an outer hard plastic case to further protect the shelter. The two cases are stored within a woven canvas case that can be attached to a belt.

G. Training for shelter use should be on-going.
   1. **Training shelters** should be employed for training sessions.
   2. The goal is a 30-second deployment time (from opening the case to being inside the shelter) for field situations.

MODULE IX: NIIMS INCIDENT COMMAND SYSTEM REVIEW

OBJECTIVE: To develop basic competency pertaining to NIIMS.

I. During 1996, after the Miller's Reach Fire, the Governor signed an Administrative Order mandating that the NIIMS ICS model be used in Alaska. **The NIIMS model is very similar to the ICS system currently in use throughout the Mat-Su Borough. Per Mat-Su Chiefs & Public Safety Dept, NIIMS has been adopted. The following is a brief explanation of the similarity & differences.**

II. Incident Command (IC). The purposes, functions, responsibilities & authority of Command remain the same.
   A. **Command staff** personnel of Safety, PIO & Liaison are the same. Each is called an "**Officer" (e.g., Safety Officer).**
   B. **General staff** personnel composed of Operations, Planning, Logistics, and Finance/Administration are the same.
      1. **Sections:** Operations, Planning, Logistics, and Finance/Administration. The functions of sections are the same.
      2. Each is managed by a "**Section Chief."**

III. **Divisions/groups versus Sectors:**
   A. **Divisions** are the same as **Area Sectors**. Divisions have responsibilities within a defined geographic area. In terms of a structure:
      1. Exterior

Exterior	*Division A	=	Front Sector
	*Division B	=	Left Sector
	*Division C	=	Rear Sector
	*Division D	=	Right Sector

2.	Interior	*Division 1	=	Interior or Sector 1
		*Division 2	=	Interior or Sector 2
		*Division 3	=	Interior or Sector 3
		*Subdivision 1	=	Basement Sector

B. **Groups** are the same as **Function Sectors**. Groups have specific functional assignments. In terms of a structure fire:

1.	Water Supply Sector	=	Water Group
2.	Rescue Sector	=	Rescue Group
3.	Ventilation Sector	=	Vent Group
4.	Rehab/medical sector	=	Rehab/medical group
5.	Haz. Mat. Sector	=	Haz. Mat Group

C. **Divisions/groups/sectors are managed by "Supervisors."**

IV. Within **Divisions & Groups**, there are **three levels of resources:**

A.	**Single Resource** (Managed by Crew Boss)	=	An engine, a tender, a C-V, a brush unit, a medical team.
B.	**Strike Team** (Managed by Leader) (Common communications)	=	A grouping of **one kind** of resource; a strike team of 5 engines, a strike team of tenders, a strike team of ambulances.
C.	**Task Force** (Managed by Leader) (Common communications)	=	A grouping of **mixed kinds** of resources; a task force of 2 engines, a brush unit, a tender & C-V; a task force of 3 ambulances, one rescue & one C-V.

V. For **large-scale incidents**, one additional level of organizational structure of provided = **Branch.** Branches can be **functional or geographic (area).** For the most part, branches are used due to the need to limit the span-of-control **OR** there is a need to organize based on a functional structure.

A. **Geographic (area) branches:**
   1. Example one: North Branch, South Branch.
   2. Example two: Branch I, Branch II, Branch III

B. **Functional branches:**
   1. Example one: Fire Branch, Air Ops. Branch
   2. Example two: Fire Branch; Medical Branch

C. **Branch managers are called Directors.**

VI. The NIIMS model -
IC (Command & Officers of Command Staff)
Sections (Potentially Four Section Chiefs)
Branches (Directors)
Divisions/Groups (Supervisors)
Strike Teams/Task Forces (Leaders)
Single Resource (Crew Boss, Squad Boss, Foreman)

VII. The three Command Staff positions which can be established to assist the IC are:

A. **Safety Officer** monitors hazardous and unsafe situations, and develops measures for assuring personnel safety. The Safety Officer has emergency authority to stop and/or prevent unsafe acts.

1. **Mat-Su Borough Policy**: While the IC can delay the appointment of a Safety Officer due to incident factors & priorities, this ICS staff position **must** be filled during structure fires, extended attack wildland or urban interface fires, and many other extended attack operations.

B. **Information Officer,** when appointed, will be the point of contact for the media or other organizations seeking information directly from the incident. This position is rarely filled.

C. **Liaison Officer,** on large incidents, will be the primary contact for representatives (MEA, Red Cross) assigned to the incident to coordinate their agency's involvement.

Appendix B

SRTUCTURAL FIREFIGHTING FOR WILDLAND FIREFIGHTERS TRAINING PROGRAM

DEVELOPED FOR FORESTRY PERSONNEL
BY
Johnny Murdock
DEPERTMENT OF PUBLIC SAFETY
MATANUSKA-SUSITNA BOROUGH

1999

WITH THE
ASSISTANCE & APPROVAL
OF
FIRE SERVICE TRAINING COMMITTEE
MAT-SU FIRE CHIEFS ASSOCIATION
DIVISION OF FORESTRY—BIG LAKE

PREFACE:
STRUCTURAL FIREFIGHTING FOR WILDLAND FIREFIGHTERS

The SFWF Program is designed to provide the fundamental knowledge and skill competencies necessary for an individual to function in exterior structural firefighting roles on firegrounds and interface fires. The SFWF Training Program is an entry-level program designed to supplement the on going firefighting training efforts among forestry personnel

The following manual shall be used by students in the SFWF Training Program: **Essentials of Firefighting (4th edition).** All individuals participating in the Training Program are required to have and wear a complete set of firefighter protective clothing as defined by the Department of Public Safety.

Upon successful completion of the SFWF Training Program, each person will receive a “Structural Firefighting for Wildland Firefighters” Certificate from the Department of Public Safety. "Successful completion" is defined as

a. 80% class attendance (make-ups are allowed within reason).

b. Passing the program's written exam with a minimum score of 75%. For individuals with reading disabilities, alternative testing may be provided.

c. Passing all practical skill tests.

****For both written and practical skill exams, re-tests are allowed up to three times with the approval of the Fire Training Coordinator.

SFWF TRAINING PROGRAM
ACKNOWLEDGMENTS

Fire service personnel throughout the Matanuska-Susitna Borough contributed their time and expertise to the development of the original Support Firefighter Training Program and its revisions. Without the assistance of many individuals, these programs would not have been developed.

Special thanks go to the Fire Training Committee, the Mat-Su Fire Chiefs Association and Big Lake Forestry for their work in developing, revising and refining these entry level programs.

Kevin Koechlein, Director
Department of Public Safety

Johnny Murdock
FSA Training/Safety Coordinator

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MODULE I
Mat-Su Department of Public Safety: Orientation

The following definitions/explanations reflect minimum standards for fire services within the Mat-Su Borough. All fire services shall comply with the minimum standards. Any fire service may institute additional requirements for its personnel.

1. **Basic Firefighter Trainee:** "Basic Firefighter Trainee" is the term used to describe the status of a new fire service member. While in Trainee status, individuals are expected to attend fire department meetings and participate in the basic firefighter training program (as available). Unless explicitly approved by the Trainee's FSA Chief, Basic Firefighter Trainees are not allowed to respond to fires. If authorized to respond to fires, Trainees shall respond Code Yellow. On a fireground, Trainees shall not function in the Hot Zone, but may under supervision carryout support functions in the Warm Zone. Trainees shall not respond outside their response area on mutual aid fire calls. Basic Firefighter Trainee helmets shall have **Blue** reflective tape and no other markings.

2. **Basic Firefighter:** "Basic Firefighter" is the term used to describe the status of an individual who has successfully completed basic firefighter certification (i.e., includes practical and written examinations). Basic Firefighters can carryout tasks/functions within the limitations of their training, and while under the direction and supervision of an officer or more experienced and qualified firefighter. Basic Firefighters are authorized to respond outside their response area on mutual aid fire calls **only if** they have received written authorization from their FSA Chief. The reflective tape worn on the helmets of Basic Firefighters is **Blue plus Firefighter Rockers on each side.** Individuals who complete the Basic Firefighter training program but do not certify shall retain the helmet color code of Basic Firefighter Trainee's.

3. **Advanced Firefighter Trainee:** "Advanced Firefighter Trainee" is the term for persons who have received Basic Firefighter Certification and who are in some phase of the Advanced Firefighter Training program. The Mat-Su Department of Public Safety recognizes that advanced firefighter training within the local service may extend over many months and that involvement in the limited boroughwide program offerings may not always be feasible. As a Basic Firefighter develops additional firefighting competencies, the FSA Chief may authorize the individual to perform in more advanced roles. The reflective tape and rockers worn on Advanced Firefighter Trainee helmets are the same as a Basic Firefighter.

4. **Advanced Firefighter:** "Advanced Firefighter" is the term used to describe the status of an individual who has successfully completed the Advanced Firefighter Training Program (i.e., includes practical and written

examinations). On a fireground, Advanced Firefighters can carryout the full range of exterior/interior firefighting tasks/functions. Advanced firefighters can respond outside their response area on mutual aid calls. The reflective tape worn on Advanced Firefighter helmets is **White plus Firefighter Rockers on each side.**

Structural Firefighting For Wildland Firefighters
Instructional Modules

		Approx. Hours
I	Orientation, including safety overview	1
II	Fire Behavior	3
III	Protective Clothing & Self-Contained Breathing Apparatus	5
IV	Hose & Water Supply	8
V	Fire Streams	4
VI	Extinguishers	1
VII	Ladders	4
VIII	Forcible Entry	2
IX	Ventilation	2
	Written examination	0.5
	Practical examination	1.5
	TOTAL	32 hours

Program Notes

THE GOAL OF THE FIRE SERVICE IS THE PROTECTION OF LIFE AND PROPERTY FROM THE DANGERS OF FIRE AND OTHER EMERGENCIES.

1. **Firefighting is a team effort: All tasks/functions are important since a joint and coordinated effort is required to safely and successfully fight fire.**
   a. Basic firefighter roles, while requiring less training, are essential to effective firefighting operations.
   b. "Team effort" means
      (1) Everyone relies and counts on everyone.
      (2) Everyone looks out for the safety of everyone.

2. **"Controlled Aggression describes our approach to fighting fire. FIRE is the enemy -- We use resources to aggressively attack fire.**
   a. Fire Attack Strategies.
      (1) Offensive Strategy: Selected when fire conditions will allow an effective interior attack.
      (2) Defensive Strategy: Selected when fire conditions prevent an effective interior attack and dictate an exterior operation.

3. **In training and emergency operations, SAFETY is always a priority.**
   a. NFPA 1500: Impact on fire service and relation to BFF.

4. Borough Fire Service Standard Operating Procedures. These are adopted after review and recommendation from the Mat-Su Fire Chiefs Association.

5. The fire service, volunteer and career, is a paramilitary system. In nonemergency situations, we tend to be informal. In emergency situations, lines of authority and chain-of-command are formally followed.
   a. "Freelancing" is neither allowed nor tolerated during emergency operations.
   b. Incident Command System (ICS): A later module.
   c. Personnel Accountability - how the system works.

6. During training, safety is a priority.
   a. The operative word to stop unsafe acts or prevent an injury is "FREEZE."
   b. Stress the importance of safety
      (1) During training
      (2) Riding in apparatus
      (3) When functioning around apparatus and equipment
      (4) At emergency incidents
      (5) In station

7. Review types of fire apparatus
   a. Engine/pumper
   b. Pumper/tanker
   c. Tanker
   d. Brush
   e. Aerial
   f. Rescue & rescue support
   g. Command and support

8. Review typical response procedures
   a. Single apparatus: Trash fires, car fires
   b. Full response: Structure fires
   c. Mutual aid responses
   d. POV response

9. Relationship to and role of other agencies with which we work:
   a. State Troopers and/or local PD's.
   b. State Fire Marshal
   c. Department of Environmental Conservation
   d. Red Cross, churches & community assistance groups

10. Critical Incident Stress: The resource and how it operates.

11. Outline of Course Parameters:
   a. Course schedule & delivery issues
   b. Practical & Written Exams
   c. How to obtain extra help
   d. Fire or other alarm: Response issues from class.

MODULE II: FIRE BEHAVIOR

OBJECTIVES: To develop competency pertaining to

1. Characteristics of fire and burning process
2. Phases of a structure fire & fire attack priorities
3. Conditions for backdraft and methods for prevention
4. Factors leading to rollover and flashover
5. Methods of heat transfer
6. Products of combustion
7. Classes of fire and methods of extinguishment

Definitions

1. Air = 21% oxygen, 78% nitrogen, 1% other gases
2. Heat = The form of energy that raises temperature
3. BTU (British Thermal Unit) = heat necessary to raise one pound of water one degree F
4. Boiling point = The temperature of a substance where the rate of evaporation exceeds the rate of condensation
5. Flash point = minimum temperature necessary to produce a flash, but where fuel will not continue to burn
6. Fire Point = minimum temperature necessary to support sustained combustion, usually a few degrees above the flash point
   **Note: Flash point and fire point refer to liquids
7. Ignition temperature = temperature when fuel (gas) in air is heated to the point where it will sustain combustion
8. Endothermic heat reaction = a chemical reaction where the substance absorbs heat
9. Exothermic heat reaction = a chemical reaction where the substance gives up heat
10. Flammable or Explosive limits = The percentage of a substance in air that will burn once ignited (upper limit (too rich) & lower limit (too lean)
11. Oxidation = a chemical reaction of organic materials with oxygen
12. Pyrolysis = The process by which fuel gases are evolved from solids. ONLY GASES BURN.

Four Sources of Heat Energy

(Each source defined by primary example)

1. Chemical heat energy: Heat of combustion = The amount of heat generated by the combustion (oxidation) process.
2. Electrical heat energy: Resistance heating = The heat generated by passing an electrical force through a conductor such as a wire or appliance.

3. Mechanical heat energy: Frictional heat = The heat generated by the movement between two objects in contact with each other.
4. Nuclear heat energy: Nuclear fission and fusion = The heat generated by the splitting and/or combining of atoms.

The Burning process

1. Fuels naturally exist in one of three states of matter: Solid, liquid, or gas. ONLY GASES BURN. Fuel gases are produced by solids through PYROLYSIS. Pyrolysis for wood (most carbon) products:

Temperature	Reaction
392 degrees F	Production of water vapor, carbon dioxide, formic acid and acetic acid
392-536 degrees F	Less water vapor, some CO (primarily an endothermic reaction)
536-932 degrees F	Exothermic reaction with flammable vapors
Over 932 degrees F	Residue of primarily charcoal

2. Facts to remember:
   a. Specific gravity = The density of liquids in relation to water. Water = 1. Liquids with a specific gravity of less than one are lighter than water (e.g., most flammable liquids, gasoline = .8)
   b. Vapor density = The density of gas or vapors in relation to air. Air = 1. Gases with a vapor density if less than one will rise and tend to dissipate in air (e.g., natural gas = .6). Gases with a vapor density greater than one will sink and hug the ground (e.g., propane = 1.6; gasoline = 3.5)
   c. Examples of Flammable Limits at 70 degree F.

Fuel	Lower Limit	Upper Limit
Gasoline vapor	1.4	7.6
Natural gas (methane)	5.0	17
Propane	2.2	9.5
Hydrogen	4.0	75
Acetylene	2.5	100

Elements of Fire

COMBUSTION: The self-sustaining process of rapid oxidation of a fuel being reduced by an oxidizing agent along with the evolution of heat and light. FIRE IS A CHEMICAL REACTION.

1. Fire Triangle (best represents surface or smoldering mode of burning process)
    a. Fuel
    b. Heat
    c. Oxygen
2. Fire Tetrahedron (best represents flaming mode of burning process)
    a. Reducing agent (fuel)
    b. Temperature (heat)
    c. Oxidizing agent (oxygen)
    d. Chemical chain reaction

    **Link to methods of extinguishment: (1) Remove Fuel, (2) Exclude or reduce oxygen, (3) Lower Temperature, (4) stop chemical chain reaction.
3. Some interior firefighting considerations
    a. Normal air = 21% oxygen
        (1) Burning stops when oxygen is reduced to 15%
        (2) What lack of oxygen does
            **17% - some impairment (loss of mental capability)
            **12% - dizziness, headache, rapid fatigue
            **9% - unconsciousness
            **6% - death within a few minutes
    b. Danger
        1st heat
        2nd toxic gases
        3rd lack of oxygen
    c. In moving victims,
        (1) If a victim is conscious, keep the person low and accompany the person out of the structure. Turn the person over to qualified personnel. DO NOT leave such individuals without supervision.
        (2) If a victim is unconscious, keep the person low and stabilize (control) the head
    d. For firefighters, given the threat posed by heat and gases, DO NOT remove the facepiece.

Phases of a Confined Structure Fire

1. First phase - Incipient Phase
   a. Room temperature around 100 degrees
   b. Rising hot gases
   c. Air approximately 20% oxygen
   ** Fire is easy to extinguish by direct attack
   ** Use 20-30 degree fog

2. Second phase - Free-Burning/Steady-State Phase
   a. Ceiling temperature over 1300 degrees
   b. Heat and gases accumulate in upper areas
   c. Reduced oxygen supply
   ** A combination attack followed by a direct attack may be required
   ** Use 20-30 or 30-40 degree fog depending on conditions

3. Third phase - Hot-Smoldering Phase
   a. Temperature high throughout - around 1000 degrees
   b. Fire gases (CO and Carbon) prevalent - danger of backdraft
   c. Oxygen below 15%
   ** Horizontal ventilation may cause backdraft. Vertical ventilation will create free-burning fire
   ** Entry may require indirect attack (60 degree fog). Advance may require combination attack.

Special Conditions & Considerations

1. Backdraft - A danger during the smoldering fire phase
   a. Signs of potential backdraft
      (1) Smoke rising under obvious pressure
      (2) Smoke leaves building in puffs
      (3) Black smoke becomes gray yellow or brownish
      (4) Confined with high heat
      (5) Little or no visible flame
      (6) Smoke-stained windows
      (7) Muffled (groaning) sounds from building
      (8) Sudden movement of air inward when opening is made
   b. Relate to vertical ventilation

2. Flashover - When a room's content are heated to the point where simultaneous ignition occurs over the entire surface or area.

3. Rollover - When fire gases near ceiling are heated to 600-900 degrees F and there is sufficient oxygen, fire will roll across the ceiling. Depending on the heat layers, rollover can occur a few seconds or a couple of minutes before flashover. A danger in terms of fire extension and trapping interior crews. Note: Rollover may be partially or largely hidden by smoke.

4. A fire may advance to the third stage while confined to one or two rooms. ALWAYS checks doors prior to opening.

5. During the 2nd or 3rd stage of a fire, the fire may vent itself through a window, door or roof. Be careful when approaching a structure which may contain a confined fire.

6. When a structure is fully involved in fire (i.e., the fire has vented through the roof and, perhaps, walls), there is the danger of COLLAPSE. The collapse danger zone is, at least, 1 1/2 times the height of the structure.

7. Firefighting notes:
   a. From a firefighter's perspective, opposing hoselines can create backdraft/flashover type effects. With few exceptions, DO NOT operate an exterior line when a crew is operating in the interior of a structure. Also, a flammable liquid explosion can produce flashover type effect.
   b. IF CAUGHT in a backdraft, flashover or similar situation, the following sequence of actions are necessary for survival.
      (1) Get as low as possible (i.e., on your belly) SPECIAL NOTE - In a flammable liquid explosion, do not lie in burning product (staying on knees may be the best alternative)
      (2) Nozzleperson must
         (a) Open nozzle to wide-angle fog
         (b) Elevate nozzle upward and circle
      (3) Fight the fire off the crew. Then retreat or advance depending on the magnitude of remaining fire conditions
   c. If rollover is encountered and poses an immediate threat, direct a 30-40 degree in a circular manner on the ceiling area. Then continue to advance, but check overhead every 10-15 seconds.
      (1) The temperature on the ceiling is usually as much as a thousand degrees higher than on the floor.
      (2) Directing a fire stream toward the ceiling will upset the thermal balance in the room, firefighters will be enveloped in a steam cloud, and the location may become so hot that further advance is impossible (i.e., in fact, retreat may be required).
      (3) Advancing toward the seat of the fire underneath flames rolling over a ceiling or out a door is often required for an effective fire attack.

Special Note: Constantly check for and monitor rollover. However, use fire stream on rollover only when it is an immediate threat.

Heat Transfer

1. **LAW OF HEAT FLOW:** Heat tends to flow from a hot to a cold substance.
   a. Primary basis of the rule: Attack from the unburned side
2. **Conduction:** Heat may be conducted from one body to another body by direct contact.
   a. Metals are good conductors, wood is a fair conductor, liquids and gases are poor conductors.
3. **Convection:** The transfer of heat by the movement of air or liquid. Heated air will expand and rise - convection is generally up.
   a. Direct flame contact is a special case of convection
4. **Radiation:** Radiated heat (heat waves) travel through space until the waves strikes an object (skin, another building, etc.)

Products of Combustion

1. Fire Gases (Carbon monoxide & dioxide, sulfur dioxide, hydrogen chloride and cyanide, phosgene)
2. Heat
3. Flame
4. Smoke (unburned particles)

Classes of Fire

1. **Class A:** Ordinary combustible materials such as wood, cloth, paper, rubber and many plastics
   a. Generally, extinguish by cooling with water
2. **Class B:** Fire involving flammable liquids, greases, and gases
   a. Best method of extinguishment is smothering (removing supply of oxygen). Generally, do not use water.
3. **Class C:** Any fire involving energized electrical equipment.
   a. Can use nonconducting extinguishing agent. BEST to shut-off power source and treat as Class A or B fire.
4. **Class D:** Fires involving combustible metals.
   a. Need special extinguishing agents. Water is generally NOT effective and should not be used.

MODULE III
PROTECTIVE CLOTHING &
SELF-CONTAINED BREATHING APPARATUS (SCBA)

OBJECTIVES: To develop basic competency pertaining to

1. Importance of wearing protective clothing
   --Limitations of protective clothing
2. Care and cleaning of protective clothing
3. Importance of SCBA and its use
4. SCBA operating procedures, including
   --Donning of facepiece
   --Donning of airpack
   --Wearing & working in an SCBA
   --Changing air bottles
   --Visual inspection & basic (MSA level 1) maintenance

Protective Clothing

1. Mat-Su Borough Protective clothing: Helmet with faceshield, turnout coat, turnout pants, boots, gloves, hood. Issued by FSA.
   a. PASS, eye protection, hearing protection equipment: When and how to use.
2. Conditions for wearing protective clothing:
   a. Review SOP rules for Hot-Warm-Cold zone requirements
      (l) Hot Zone: Established by IC as the area of significant risk. Rule-of-thumb is 25 feet.
      (2) Warm Zone: Operational area, including all apparatus and equipment.
      (3) Cold Zone: Area beyond (outside) warm zone.
   b. Review limitations of protective clothing.
   c. Review issues pertaining to eye and hearing protection.
3. Care and cleaning of protective clothing
   a. Stress that chemicals (combustion products & dirt) will degrade protective gear.
   b. Note that bleach is NEVER used to clean turnouts.

SCBA

1. Review Respiratory Hazards: Toxic gases, elevated temperatures, smoke, oxygen deficiency
   a. Toxic gases common in structure fires
      (1) Carbon monoxide & Hydrogen cyanide bond with red blood cells and exclude oxygen
      (2) Carbon dioxide displaces oxygen in the lungs
      (3) Phosgene and nitrogen oxides form various acids within the lungs
      (4) Hydrogen chloride can damage the eyes, lungs, and cause heart irregularities.
      **Note that toxic gases may occur in a variety of nonfire situations (e.g. leaks and spills)
   b. Elevated temperatures: Air quickly inhaled at 120-130 degrees F can cause serious lung damage.
   c. Smoke: May contain irritating and lethal particles
   d. Oxygen deficiency:

21% oxygen	=	normal air
17% oxygen	=	some impairment of muscular Coordination
12% oxygen	=	dizziness, headache, rapid fatigue
9% oxygen	=	unconsciousness
6% oxygen	=	death within a few minutes

2. Nature of MSA Positive-Pressure SCBA: Description/discussion
   a. Cylinder
   b. Regulator
   c. Valves
   d. Gauges
   e. Harness
   f. Facepiece

3. Donning SCBA: Emphasize valve turn-on's!
   a. Donning the facepiece
      (1) Make sure straps are loose
      (2) Placing chin and fitting facepiece
      (3) Tightening straps: Bottom-to-top
      *** Note limitation of mask and seal
      *** Emphasize checking seal
   b. Donning the airpack
      (1) Overhead method
      (2) Coat method
      (3) Seat & vehicle mount methods
      *** Note the proper wearing of hood and helmet

4. Working in SCBA:
   a. Emphasize working in pairs
   b. Review visual limitations
   c. Review communication issues

5. Changing air bottles: Have all students demonstrate proper procedures

6. Review the function of cascade/filling stations

7. Inspection
   a. Visual inspection
      (1) Cylinder
      (2) Regulator
      (3) Valves
      (4) Gauges
      (5) Harness
      (6) Facepiece
   b. MSA Level I cleaning & maintenance: Students shall be trained in and demonstrate proper Level I maintenance during course.

8. Throughout the course, students will be expected to perform all tasks in full protective clothing, including (when appropriate) SCBA.

9. Training in emergency breathing (use of by-pass) must be taught to and demonstrated by students.

MODULE IV: HOSE & WATER SUPPLY

OBJECTIVES: To develop basic competency pertaining to

1. Hose construction and maintenance factors
2. Hose tools & appliances and their uses
3. Hose roles and couplings
4. Hose loads
5. Hose lays, including hose packs
6. Pulling and stretching hose
7. Basic hoseline operations
8. Water Supply system components & factors

Introduction to Hose

1. Characteristics of hose
   a. Brief review of hose construction.
      (1) Note that structural fire hose is double-jacketed while most forestry hose is single-jacketed.
   b. Review causes of fire hose damage & ways to prevent damage, including laying out & picking-up hose.
   c. Review methods for hose care and cleaning.
   d. Introduction to couplings
      (1) Threaded couplings: Male, Female & Higbee cut
      (2) Storz quick connect couplings
   e. Mat-Su Borough structural hose: 1 ¾", 2 ½" & 3" hose.
      (1) Note that some FSA's have large diameter (4 ½" & 5") hose
   f. Forestry hose is 1 ½", 1" & some ¾". It is lightweight.
   g. Note hose test procedures and the need to maintain accurate hose records. Hose test pressures for forestry hose are less than structural hose.

2. Review hose tools and appliances and their uses. Stress that each individual needs to become familiar with the equipment on their service's apparatus.
   a. **Wye appliances**: Both structural & light weight forestry.

   b. **Siamese appliances**: Both structural & lightweight forestry (Forestry sometimes calls this appliance a "reverse wye").

   c. **Adapters/reducers**: Common are 2 ½"-to-1 ½", 1 ½"-to-1" although there are a variety of other types.

   d. **Double males & females**: Mostly 2 ½" & 1 ½"

   e. **Hydrant gates**: Often a 2 ½" X 2 ½" X 2 ½" wye.

f. **Hose clamp tool**: Both structural & light weight forestry

g. Hose bridges

h. Foam eductors

i. Hose hoist (roller) tool

j. **Hydrant wrench & Spanner wrench**

k. **Rubber mallets**

l. **hose straps**

Hose Rolls

1. Mat-Su hose rolls

   a. Straight roll (most common forestry roll, called "single roll").

   b. Donut roll (forestry calls "double roll").

   c. Hotel/Bundle hose load. Cover/demonstrate horseshoe & accordion methods for 100' loads.
      (1) Note: Forestry does use an accordion load as a hose pack.

2. Coupling & uncoupling hose

   a. Foot-tilt method

   b. Over-the-hip method

   c. Two-firefighter method

   d. Use spanners for tight or frozen couplings

Structural Apparatus Hose Loads

1. Note loading considerations with variations in hose beds and other loading factors.
2. Loads for 2 ½" and 3" hose
   a. **Flat load**--Note large diameter hose must be loaded flat.

   b. **Accordion load**

   c. **Dutchman**: When and how to use.

3. Preconnect loads: Two major variations within Borough
   a. **Minuteman load**

   b. **Triple-tier load**

Structural Apparatus: Water Supply Hose Lays

1. **Forward lay**: Stress as the most common within the borough.

2. **Reverse lay**: Note use of double male & double female to reverse direction of lay.

Water Supply

1. Review issues pertaining to
   a. Evaluating water sources
      (1) Structure fires: Need larger sources capable of supplying gpm needs.
      (2) Wildland: Small creeks, wells, even hot tubs can often supply the lower gpm requirements.

   b. Drafting (fill site) operations

   c. Supply (dump site) operations

   d. Large volume operations: Use of multiple port-a-tanks
      (1) Cover water transfer devices and other equipment.

2. Involve students in: Stress importance of Water Supply operations

   a. Setting-up a fold-a-tank operation. Note considerations on positioning, including need to tie-down if involved in aerial supply operation.

   b. Connecting hard suction for drafting operations

   c. Making connection for a nurse tanker operation

   d. Taking a hydrant: Dry Barrel & Dry Hydrant Operations

   e. Setting-up a portable pump draft operation.

3. Review tanker/tender operation options

   a. Nurse tanker

   b. Dump and run

   c. Pump to Dump

4. Review apparatus staging issues, including road access and scene safety issues.

Pulling and Stretching Hose

1. Pulling hose from apparatus: Review & stress safety issues.
   a. Pulling preconnect hoselines

   b. Creating additional hoselines

   c. Pulling Supply Line. Have students "PIN" hose for forward/reverse lays

2. Stretching and advancing hoselines for structural fire attack
   a. Advancing into structures

   b. Advancing up stairways

   c. Advancing dry hose up a ladder

   d. Advancing a charged line up a ladder

   e. Operating a charged line from a ladder

   f. Passing a hose upward

   g. Extending a hoseline

   h. Replacing a burst section of hose

3. Operating Hoselines
   a. Proper methods for opening and closing nozzles

   b. Methods of proper body position for controlling hoselines

   c. One and Two firefighter methods for operating handlines. **ALL INTERIOR AND MOST EXTERIOR OPERATIONS REQUIRE A MINIMUM OF TWO FIREFIGHTERS.**

Pulling and Stretching Hose: Drills

1. Singly and in pairs, students shall pull and stretch preconnects to a proper hoseline placement. Have students repack preconnects.

2. Given 100' of 3" hose, 200' of 1 ¾" hose, a gated wye and two nozzles, have student build a line from an engine.

3. Have students practice extending a 1 ¾" hoseline and replacing a section of line.
   a. Explain the proper procedures for dealing with a loose hoseline.

4. In pairs, have students operate a 1 ¾" hoseline with variations in pressure.

5. Additional drills at instructor option if time allows.

MODULE V: FIRE STREAMS & NOZZLES

OBJECTIVES: To develop basic competency pertaining to

1. Advantages and disadvantages of water as an extinguishing agent
2. Uses of fire streams
3. Types of pressure
4. Water hammer and friction lose
5. Types of fire streams & nozzles, including master stream devices
6. Fundamentals of foam & foam application.
7. Methods of interior fire attack

Advantages & Disadvantages of Water

1. Fire streams
   a. Affected by
      (1) Velocity
      (2) Wind
      (3) Gravity
      (4) Friction with air
   b. Condition of stream affected by
      (1) Operating pressure
      (2) Nozzle design
      (3) Nozzle adjustment
      (4) Condition of nozzle

2. Water
   a. Composed of hydrogen and oxygen (H20)
   b. Converts to a solid (ice) at 32 degrees F
   c. Converts to steam at 212 degrees F
   d. A cubic foot of water weighs 62 lbs.
   e. At 212 degrees, a cubic foot of water expands 1,700 times its original volume.

3. Advantages of water
   a. Greater heat absorbing capacity than other common agents
   b. A large amount of heat is required to change water into steam
   c. The greater the surface area of the water that is exposed, the more rapidly heat will be absorbed
   d. Water converted into steam occupies several hundred times its original volume
   e. Water is widely available and a low, often no, cost
   f. May cause additional property damage

4. Disadvantages of water
   a. Surface tension limits soaking ability
   b. Reacts violently with certain materials and chemicals
   c. Low viscosity allows it to run off surfaces quickly
   d. A good conductor of electricity
   e. When water freezes, it can be hazardous to personnel and equipment

5. Fire Stream Selection and Application
   a. Protect exposures
   b. Control the spread of fire
   c. Attack (extinguish) fire

Types of Pressure: A Brief Introduction

1. Static Pressure (water not flowing (moving)): Static pressure is stored potential energy that is available to force water through pipes, fittings, fire hose, nozzles and adapters.

2. Normal Operating Pressure: Normal operating pressure is that pressure which is found on a water distribution system during normal consumption demands.

3. Residual Pressure: Residual pressure is that part of the total available pressure that is not used to overcome friction or gravity while forcing water through pipes, fittings, fire hose, nozzles and adapters.

4. Flow pressure: Flow pressure is that forward velocity pressure at a discharge opening while water is flowing.

5. Friction Loss: Friction loss is that part of the total pressure that is lost while forcing water through pipes, fittings, fire hose, nozzles and adapters.
   a. Link to differences between 1 ¾” and 3" hose for explanatory purposes
   b. Stress that it is critical to keep sharp bends or kinks out of hoselines

6. Water hammer: Water hammer is the resulting back pressure surge caused when the flow of water through hose or pipe is suddenly stopped.
   a. Water hammer can cause damage to fire pumps, hose, water mains, and plumbing
   b. Nozzles, hydrants, pump panel valves, and hose clamps should NEVER be suddenly stopped. Have students demonstrate proper nozzle shutdown.

Types of Fire Streams & Nozzles

1. Solid streams
   a. Characteristics
      (1) Little or no shower/spray
      (2) Excellent reach and penetration
   b. Except for smooth bore tips for master stream devices, no solid stream nozzles are used in Mat-Su Borough.

2. Fog streams
   a. Characteristics
      (1) Adjustable from Straight stream to wide angle fog pattern
      (2) Water broken into finer particles - more surface area to absorb heat
      (3) Definite pattern of water stream
      (4) High water to steam ratio
   b. The flexibility of fog streams make them preferred for most firefighting operations, especially interior fire attacks.
   c. Mat-Su Borough standard for structural firefighting is Task Force Tip automatically adjusting fog stream nozzles.

3. Special nozzles: Chimney nozzles, piercing nozzles, rotary nozzles
   a. Students must be able to identify and explain the function of all nozzles carried by their department

4. Master Stream devices (monitors, deck guns): Too large to be controlled without mechanical aid. May be equipped with solid stream or fog stream nozzle.
   a. Purpose is to deliver large volumes of water (e.g., 500-1000 GPM)

5. Review care & cleaning of nozzles, and the importance of proper maintenance.

A Brief Classroom Introduction to FOAM

1. Introduce students to characteristics and types of foam

   a. Class A Foam. Primarily used for wildland fires, but has other applications.

   b. Class B Foam. Used for Class B fires. In Mat-Su Borough, the foam used is AFFF.

2. Review type of nozzles & systems, including use of fog nozzles & aspirating attachments, and special aspirating nozzles.
   a. Note that Compressed Air Foam systems are becoming more common around the country. There are a wide variety of CAF systems.

3. Briefly outline methods of applying Class B foam

   a. Push/roll method
   b. Deflection/bounce method
   c. Snow flake method

4. Review methods of applying Class A foam

   a. Direction attack/suppression.
   b. Coating/protection.
   c. Cover/extinguish.
   d. Use as wet water.

5. **Stress the need to thoroughly clean any foam equipment and/or system after use.**

Fire Stream Selection & Placement: Structural Attacks

1. Offensive versus Defensive Strategy
   a. Review of issues pertaining to coordination with forcible entry and ventilation

2. Offensive strategy
   a. Placing the initial attack line

   b. Placing and coordinating additional attack lines

3. Defensive strategy
   a. Placing the initial attack line

   b. Placing and coordinating additional attack lines

4. Fire Streams & Water Supply: Needed Fire Flow Requirements

MODULE VI: EXTINGUISHERS

OBJECTIVES: To develop basic competency pertaining to

1. The classes of fire extinguishers, including symbols and colors
2. Multipurpose extinguishers (dry chemical)
3. How to use an extinguisher on Class A and Class B fires

Classes of Fire Extinguisher

1. Ordinary combustible products: Class A (Green Triangle)
2. Flammable liquids: Class B (Red Square)
3. Electrical equipment: Class C (Blue Circle)
4. Combustible metals: Class D (Yellow Star)

Mat-Su Fire Extinguishers

1. Dry chemical extinguishers (rated for A, B, C fires) multi-purpose base. This is the most common and widely used extinguisher within the borough. Focus of this training.
2. Note: A few services carry CO2, water and/or AFFF extinguishers.

Operating an Extinguisher

1. **PASS**
   - **P** - Pull pin
   - **A** - Aim
   - **S** - Squeeze handle
   - **S** - Sweep back and forth

2. Purpose & function of portable extinguisher rating system.
3. When using an extinguisher, one should be in full protective gear with the face shield down.
   a. Stay Low
   b. Approach product from Upwind
   c. Approach from Uphill
      **Note that approaching upwind versus uphill will often contradict. Select the safest approach possible.
4. With Class A products, apply the agent at the base of the flames.
   a. Be prepared for rekindle.
5. With Class B products, apply the agent over the top of the burning product and sweep back and forth. **DO NOT SHOOT THE AGENT INTO THE PRODUCT**.
6. With Class C fires, one should, if at all possible, shut-off the electricity. Then treat as a Class A or Class B fire.
7. The students shall demonstrate the proper and safe use of an extinguisher on Class A and/or B fires.

MODULE VII: LADDERS

OBJECTIVES: To develop basic competency pertaining to

1. Ladder terms and definitions
2. Ground ladders used in the Borough
3. Common uses of a ladder
4. Removing from and mounting ladders on apparatus
5. Lifting a ladder
6. Ladder carries
7. Placing, raising, securing and lowering ladders
8. Climbing ladders and carrying tools

Ladder Terms & Definitions

1. Angle of inclination
2. Base Section
3. Beam
4. Butt
5. Butt Spurs
6. Extension ladder
7. Fly
8. Ground ladder
9. Halyard
10. Hooks
11. Locks
12. Rails
13. Rungs
14. Stops
15. Tip or Top

Ground Ladders Used in Mat-Su Borough

1. Advantages & Disadvantages of Aluminum ladders
   a. Advantages
      (1) Light weight
      (2) Fairly Strong
      (3) Can be reliably visually inspected
   b. Disadvantages
      (1) Good conductor of electricity
      (2) Wet gear/person can freeze to ladder

*** **Stress ladder safety throughout ladder training**

2. Types of Mat-Su ladders
   a. 24' extension ladders
   b. 35' extension ladders
   c. Roof ladders
   d. Folding (attic) ladders
   e. Combination (A frame) ladders

3. Areas for ladder use
   a. Ventilation (roof or window access)
   b. Rescue (2nd or 3rd floor access)
   c. Hoseline operations (interior and exterior)

4. Ladders should be cleaned and inspected after each use

Removing and Carrying ground ladders

1. Removing and mounting ladders

   a. Stress proper lifting and lowering techniques

   b. Review and demonstrate one, two and three-person ladder removal and mounting techniques.
      (1) Stress safety. Note that two persons are recommended for removing & mounting a 24' ladder and that three-four persons are recommended for removing/mounting a 35' ladder. The number of personnel required for these evolutions is dependent on the height and physical condition of those involved.

2. Ladder carries

   a. One person low-shoulder carry for roof and 24' ladders
      (1) Roof ladders carried with tip end forward
      (2) All other ladders carried with butt end forward

   b. Two person low-shoulder and flat (arms-length) carry for 24' ladder

   c. For 35' ladders, three/four person flat-arms-length carry and flat-shoulder carry
      (1) Note that four persons are always preferred for 35' ladders

Raising and lowering ladders

1. Selecting the proper ladder

First story roof	16-20 foot ladder
Second story window	24 foot ladder
Second story roof	35 foot ladder
Third story window	need 40 foot ladder

2. Placing a ladder - Review and demonstrate
   a. One-fourth length of ladder rule
   b. 75 degree of inclination
   c. Arm's length when standing at butt of ladder
   ** **Discuss common hazards**

3. Raising a ladder - Review and demonstrate proper techniques
   a. Flat raise
      (1) One person raise
      (2) Two person for 24' ladder (tying-off the halyard)
      (3) Three person for 35' ladder (tying-off the halyard)

   b. Beam raise for 24' ladder
   ** Stress that ladder extend several feet beyond windowsill or above roof line (preferably five rungs) for safety

   c. Carrying and placing a roof ladder

4. Demonstrate pivoting and repositioning of a ladder

5. Anchoring (heeling) ladders
   a. Heeling from underneath
   b. Heeling from the outside
   c. Tying-off (Securing) the halyard

6. Climbing ladders (with and without tools)
   a. Have students properly climb to at least 10-12 feet off the ground
   b. Have students properly get off and on ladder from a roof
   c. Have students properly carrying hand tools up and down ladder
   d. Have students lock-in on ladder (leg-lock)

MODULE VIII: FORCIBLE ENTRY

OBJECTIVES: To develop basic competency pertaining to

1. The reasons for forcible entry
2. General building construction, specifically types of doors and windows
3. Identification and common uses of forcible entry tools
4. Location of forcible entry tools on apparatus in their FSA
5. Techniques for opening doors, windows, walls and floors
6. Proper methods for carrying and starting (power) forcible entry tools
7. Tool care and maintenance, including fueling power tools and the cleaning, inspection and maintenance of forcible entry tools

Reasons for Forcible Entry Methods

1. To gain access to a structure or area of a structure
2. To search for fire extension (e.g., overhaul)
3. To create a path for the products of combustion (e.g., ventilation)

General building Construction

1. Review typical construction, including walls and roofs
   a. Cover purpose and function of fire stops
   b. Note truss construction methods typical of new construction
   c. Note the impact of snow-loads on roof stability & safety

2. Review types of doors and windows

   a. For doors cover
      (1) Fire doors
      (2) Wood versus metal doors
      (3) Stopped versus rabbeted jambs
      (4) Doors which open away versus toward the firefighter
      (5) Common garage doors

   b. For windows cover
      (1) Checkrail (double hung) windows
      (2) Casement (hinged) windows
      (3) Plate glass and lexan windows

STRESS TRY BEFORE YOU PRY

Identification of Forcible Entry Tools: Note Common Uses

1. Pick-Head Axe
2. Flat-Head Axe
3. Pry Axe
4. Crow Bar
5. Pry Bar
6. Halligan Tool
7. Pike Pole
8. Ceiling Hook
9. Chain Saw
10. K-12/Circular Saw
11. Maketa Saw
12. Bolt Cutters

** Each student shall prepare a drawing showing the location on their FSA's apparatus of the forcible entry tools of the jurisdiction.

The Basics of Forcing Windows

1. Review common window opening issues
   a. Checkrail (double hung) windows
   b. Casement (hinged) windows
   c. Barred, screened, and other opening issues
2. Reasons for forcing glass
   a. Point of entry for rescue in nonfire situations or when there is a known, but small, fire in the interior.
   b. Point of entry for firefighting
   c. Ventilation opening
3. When breaking glass
   a. If there is any wind, stand on the windward (upwind) side.
   b. Use the blunt side or part of the tool when striking glass
   c. If possible, keep your hands above the point of impact. If you must break glass which is above you, stand to the side.
   d. Strike the top part of the pane when breaking glass.

The Basic of Opening Doors--Focus on Swinging Doors

REMEMBER: TRY BEFORE YOU PRY

1. Review the following considerations
   a. Doors which open away from versus toward the firefighter
   b. Stopped versus rabbeted jambs
   c. Wood versus metal doors
   d. Door lock variations and hinge location issues

2. Techniques for forcing doors which open toward the firefighter

3. Techniques for forcing a stopped jamb door which opens away from the firefighter

4. Techniques for forcing a rabbeted jamb door which opens away from the firefighter

Opening Floors

1. While floors are either wood or concrete, the finish flooring of each may be tile, carpet, linoleum or hardwood.
   a. Need to remove the flooring finish prior to opening the floor

2. Wood floors: Techniques for opening with an axe or power saw

3. Concrete floors: In general, the time necessary to open limits the utility of opening concrete floors for many firefighting purposes.

Opening Walls

1. Techniques for opening masonry and veneered walls

2. Techniques for opening metal walls

3. Techniques for opening wood frame walls

4. Techniques for opening partitions

Other Forcible Entry Operations

1. Access through fences

2. Special Operations

Working Around Forcible Entry Tools
Basic Activities

1. Properly and Safely carrying tools
   a. Properly carrying axes, bars and Halligan
   b. Properly carrying pike pole and ceiling hook
   c. Properly carrying power saws

2. Properly and Safely starting power saws and power tools

3. Tool maintenance
   a. Fueling power tools
      ****Note various fuel mixtures & need for proper fuel.**
   b. Cleaning tools
   c. Inspecting tools

NEVER FORGET SAFETY DURING FORCIBLE ENTRY OPERATIONS

MODULE IX: VENTILATION

OBJECTIVES: To develop basic competency pertaining to
1. Objectives and advantages of ventilation
2. Factors influencing ventilation decisions
3. Common methods of vertical and horizontal ventilation
4. Tools and equipment used for ventilation
5. Using smoke ejectors and Positive-Pressure blowers

Reasons for Ventilation

1. Increases firefighter safety

2. Aids in Rescue

3. Facilitates fire attack & makes it easier

4. Reduces danger of backdraft & flashover

5. Reduces Mushrooming

6. Reduces property damage

Factors Influencing Ventilation Decisions

1. Is there a need for ventilation? Based on magnitude of the fire (i.e., amount of heat and smoke)

2. Where is ventilation needed? Based on construction, exposures wind direction, extent and location of fire. Care must be taken to avoid spreading the fire

3. What type of ventilation?
   a. May be vertical or horizontal
   b. May be forced (negative pressure) ventilation using smoke ejectors
   c. May be positive pressure using PPV blowers

Ventilation Tools and Equipment

1. For opening a roof (vertical ventilation), discuss use of
   a. Pick-head axe
   b. Power saws
   c. Pike pole
   d. Roof ladder
   e. Charged hoseline

2. For horizontal ventilation, discuss the placement and use of
   a. Smoke ejectors
   b. PPV blowers
   c. Fog streams

3. Review advantages & disadvantages of ventilation options
   a. Stress PPV is usually the Mat-Su preferred option.

4. Have students demonstrate the use of a smoke ejector or a PPV blower for horizontal ventilation.