Rules of Engagement for Structural Firefighting

Increasing Firefighter Survival

Developed by the Safety, Health and Survival Section
International Association of Fire Chiefs

Draft 10

Short

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SECTION ONE

Rules of Engagement for Structural Firefighting

Increasing Firefighter Survival

Developed by the Safety, Health and Survival Section
International Association of Fire Chief

Introduction and Background

Introduction and Background

The law enforcement and military communities long ago developed "Rules of Engagement" regarding the use of deadly force. These rules are described in short, specific terms which are easily taught and remembered. The rules define critical rapid assessments necessary to justify the use of deadly force. The rules have proven to be highly successful for both of these disciplines. The Safety, Health and Survival Section of the International Association of Fire Chiefs believes a similar concept in designing rules of engagement for the fire service would prevent firefighter injuries and fatalities.

The Safety, Health and Survival Section of the IAFC was created in 2004, an expansion from the long existing smaller IAFC Safety Committee. Presently, the Section has nearly 1,000 members, and growing. The members include chief officers and company officers from all types of fire departments, many of them safety officers, who are committed to reducing firefighter injuries and fatalities and improving all areas of firefighter safety. **Many have experience a firefighter fatality in their organization which brought a personal passion for preventing a future fatality to the Rules of Engagement project.** This large number of Section members also brings a broad depth of expertise to assist in improving firefighter safety and survival.

In February, 2008, following a year of discussion, the Section moved to formally revise and update a set of "Rules of Engagement for Structure Firefighting", which was originally released by the IAFC's previous Safety Committee in 2001. A project team was created consisting of Section members and representatives from several other nationally recognized fire service organizations. These included the Fire Department Safety Officer Association (FDSOA), the National Fallen Firefighter Foundation (NFFF), the National Volunteer Fire Council (NVFC), the National Institute of Occupational Safety and Health (NIOSH) and other organizations. All draft material has also been shared with representatives of the International Association of Fire Fighters (IAFF) who developed a joint IAFF/IAFC **"Fire Ground Survival Project".** Three Section members also participated in the IAFF project.

The direction provided the project team by the Section leadership was to develop rules of engagement with the following conceptual points;

- Rules should be a short, specific set of bullets
- Rules should be easily taught and remembered
- Rules should define critical risk issues
- Rules should define "go" or "no-go" situations
- A companion lesson plan/explanation section should be provided

Early in the revision process of the Rules of Engagement, it was recognized that two separate rules were needed – one set for the firefighter, who is exposed to the greatest risk, and another set for the incident commander who is responsible for keeping all members on the fireground safe. Thus, the two sets of Rules of Engagement described in this document. Each set has several commonly shared Rules and

objectives, but the explanations are described somewhat differently based on the level of responsibility (firefighter vs. incident commander).

A brief overview of an early draft of the "Rules" was published in the IAFC newsletter "On Scene" in the June and July, 2009, issues and readers were directed to the Sections website to review the complete document and submit comments. The website included the draft bullet Rule statements, objectives and early drafts of the explanation/lesson plans. This resulted in numerous public comments being submitted to the project team. The "Rules" were updated at the Section meeting at the annual Fire Rescue International conference in Dallas in August 2009 and again at the Sections mid-year meeting in January at the IAFC Headquarters based on public comments received over that period of time. During this period presentations on the Rules were presented at workshops at the Firehouse and FDIC conferences and the National Fallen Firefighters Foundation Safety Summit held at the Fire Academy in March, 2010, along with several other fire service conferences. The large number of public comments were received from these conferences were considered by the project team as they revised the Rules.

In August, 2010, the International Association of Fire Chiefs (IAFC) Board of Directors formally endorsed the two sets of Rules of Engagement as a "best safety practice model procedure" to be made available to fire departments to adopt as standard operating procedures/guidelines. Since the formal endorsement by the IAFC, numerous other major fire service organizations, along with individual fire departments, have adopted the Rules of Engagement.

Finally, because the revision process involved so many national fire service organizations with the broad public comment to achieve consensus, along with the increasing formal adoption by those organizations and individual fire departments, the Rules have now evolved to the point of being considered a "standard of practice" for the fire service.

The Need for Rules of Engagement

Firefighter safety must always be a priority for every fire chief and every member. Over the past three decades, the fire service has applied new technology, better protective clothing and equipment, implemented modern standard operating procedures, and improved training. According to National Fire Protection Association (NFPA) data during this same period (1976-2006) the fire service has experienced a 58 percent reduction in firefighter line of duty deaths. **But, the country has also seen a paralleling 54 percent drop in the number of structural fires over the same period – thus, reducing firefighter exposure to risk.** With a continued annual average of around 100 firefighter fatalities during the first decade of the new millennia, the question remains; have we really made a difference with all these technology improvements? Or, is there more that we can do to improve the safety culture of the American fire service? The safety, Health and Survival Section believes that the Rules of Engagement will change the culture and safety behaviors of the American fire service.

The U.S. Firefighter Disorientation Study, conducted by Captain Willie Mora, San Antonio, Texas, Fire Department, conducted a review of 444 firefighter fireground deaths occurring over a recent 16 year period (1990-2006). The project broke out traumatic firefighter fatalities occurring in "open structures"

and “enclosed structures”. Open structures was defined as smaller structures with an adequate number of windows and doors (within a short distance) to allow for prompt ventilation and emergency evacuation. Enclosed structures were defined as large buildings with inadequate windows or doors to allow prompt ventilation and emergency evacuation. Research determined that 23 percent occurred when a fast and aggressive interior attack was made on an “opened structure”. When fast, aggressive interior attacks occurred in “enclosed structures” the fatality rate rose to 77 percent. Many occurred in “marginal” or rapidly changing conditions in which the firefighter should not have been in the building.

In all these tragedies the only living Human Beings in the structures were firefighters. Firefighters were being killed trying to save buildings. Most were rebuilt.

The Boston Globe newspaper, in 2005, reviewed NIOSH firefighter fatality reports of 52 fire incidents which killed 80 firefighters. The Globe found that in only 14 of these 52 incidents was there even a suspicion that any occupants were in the building upon arrival of fire companies. In only 6 of these incidents was it determined that an occupant(s) was in the building when fire companies arrived. There were no reported civilian fatalities. This data implies that firefighters are losing their lives in buildings where no rescue of occupants is required. They died while trying to save a building – and no building is worth the life of a firefighter.

The Safety, Health and Survival Section believed firefighters and incident commanders need better guidance to assist in decision making and that Rules of Engagement would serve as a good tool.

The fireground creates a significant risk to firefighters and it is the responsibility of the incident commander and command organization officers to minimize firefighter exposure to unsafe conditions and stop unsafe practices. The fire service has always been a para-military organization when it comes to fireground operations. In most cases, the incident commander makes a decision, sends the order down to through supervisors to the company officer and crew. Fire crews generally view these orders as top down direction. There has often been little two-way discussion about options. Where this culture exists, crews have been trained to accept the order and do it – generally without question. While these orders may be viewed as valid when issued they may involve inadequate size up and risk assessment which may put firefighters in extreme risk.

There has been little national development of basic “rules” that the incident command should use in defining risk assessment process and what is too high risk that may result in a “no-go” decision. Additionally, for the individual firefighter who is exposed to the greatest risk, the fire service has not defined “Rules” for them to follow in assessing their *individual risk* and when and how to say “no” to unsafe conditions or practices. The “Rules of Engagement” changes that.

The “Rules of Engagement” have been developed to assist both the firefighter and the incident command (as well as command team officers) in risk assessment and “Go” – “No-Go” decisions. Applying the Rules will make the fireground safer for all and reduce injuries and fatalities.

The development of the Rules of Engagement integrates several nationally recognized programs and principles. They included risk assessment principles from NFPA Standards 1500 and 1561. Also included

were concepts and principles from Crew Resource Management (available from iafc.org) and data and lessons learned from the National Near-Miss Reporting System (firefighternearmiss.com). The Rules also align well with the principles of the International Association of Fire Fighters program. The development process also included review of lessons learned from numerous firefighter fatality investigations conducted by the National Institute of Occupational Safety and Health (NIOSH) Fire Fighter Fatality Investigation and Prevention Program.

It's incumbent that the fire chief and the fire departments management team ensure the safety of all firefighters working at structural fires. All command organization officers are responsible for their own safety and the safety of all personnel working with them. All officers and members are responsible are responsible for continually identifying and reporting unsafe conditions or practices and taking corrective action. The Rules of Engagement allow both the firefighter and the incident commander to apply and process these principles.

One principle applied in the Rules of Engagement is firefighters and the company officers are the members at most risk for injury or death and will be the first to identify unsafe conditions and practices. The Rules integrate the firefighter into the risk assessment decision making process. These members should be the ultimate decision maker as to whether it's safe to proceed with assigned objectives. Where it is not safe to proceed the "Rules" allow a process for that decision to be made while still maintain command unity and discipline.

It is well known that firefighting is hazardous with varying levels of risk to the firefighter**. However, firefighting is not a military campaign where lives are lost to establish a beach head.** No firefighter's life is a building which eventually will be rebuilt.

Keep all members safe so "Everyone Goes Home"!

SPECIAL NOTE: The explanation/lesson plan section of this document contains numerous NIOSH firefighter fatality investigation reports. In all the reports, two or more of the Rules of Engagement were violated. Had the "Rules" existed at the time, AND been <u>appropriately applied</u>, the incident may not have resulted in a firefighter fatality.

SECTION TWO

Rules of Engagement Project Team

RULES OF ENGAGEMENT PROJECT TEAM

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Thanks, also goes, to the many other fire service professionals who took the time to review the several drafts of the Rules of Engagement document and provided public comment. Public comment was essential to producing a quality product

SECTION THREE

Rules of Engagement Bullet List

Rules of Engagement for Firefighter Survival

- Size-Up Your Tactical Area of Operation.
- Determine the Occupant Survival Profile.
- **DO NOT** Risk Your Life for Lives or Property That Cannot Be Saved.
- Extend ***LIMITED*** Risk to Protect **SAVABLE** Property.
- Extend **Vigilant** and **Measured** Risk to Protect and Rescue **SAVABLE** Lives.
- Go in Together, *Stay Together*, Come Out Together
- Maintain Continuous Awareness of Your Air Supply, Situation, Location and Fire Conditions.
- Constantly Monitor Fireground Communications for Critical Radio Reports.
- You Are Required to Report Unsafe Practices or Conditions That Can Harm You. Stop, Evaluate and Decide.
- You Are Required to Abandon Your Position and Retreat Before Deteriorating Conditions Can Harm You.
- Declare a May Day As Soon As You **THINK** You Are in Danger.

The Incident Commanders Rules of Engagement for Firefighter Safety

- Rapidly Conduct, or Obtain, a 360 Degree Situational Size-Up of the Incident.
- Determine the Occupant Survival Profile.
- Conduct an Initial Risk Assessment and Implement a **SAFE ACTION PLAN.**
- If You Do Not Have The Resources to Safely Support and Protect Firefighters, Seriously Consider a Defensive Strategy.
- **DO NOT** Risk Firefighter Lives for Lives or Property That Cannot Be Saved. Seriously Consider a Defensive Strategy.
- Extend ***LIMITED*** Risk to Protect **SAVABLE** Property.
- Extend **Vigilant** and **Measured** Risk to Protect and Rescue **SAVABLE** Lives.
- Act Upon Reported Unsafe Practices and Conditions That Can Harm Firefighters. Stop, Evaluate and Decide.
- Maintain Frequent Two-Way Communications and Keep Interior Crews Informed of Changing Conditions.
- Obtain Frequent Progress Reports and Revise the Action Plan.
- Ensure Accurate Accountability of Every Firefighter Location and Status.
- If After Completing the Primary Search, Little or No Progress Towards Fire Control Has Been Achieved, Seriously Consider a Defensive Strategy.
- Always Have a Rapid Intervention Team in Place at All Working Fires
- Always Have Firefighter Rehab Services in Place at All Working Fires.

SECTION FOUR

Rules of Engagement Bullets and Objectives

Rules of Engagement for Firefighter Survival

Size-Up Your Tactical Area of Operation.

Objective: To cause the company officer and firefighters to pause for a moment and look over their area of operation and evaluate their *individual* risk exposure and determine a safe approach to completing their assigned tactical objectives.

Determine the Occupant Survival Profile.

Objective: To cause the company officer and firefighter to consider fire conditions in relation to possible occupant survival of a rescue *event* as part of their initial and ongoing *individual risk assessment* and action plan development.

DO NOT Risk Your Life for Lives or Property That Cannot Be Saved.

Objective: To prevent firefighters from engaging in high risk search and rescue and firefighting operations which may harm them when fire conditions prevent occupant survival and significant or total destruction of the building is inevitable.

Extend LIMITED Risk to Protect SAVABLE Property.

Objective: To cause firefighters to limit risk exposure to a reasonable, cautious and conservative level when trying to save a building.

Extend VIGILANT and MEASURED Risk to Protect and Rescue SAVABLE Lives.

Objective: To cause firefighters to manage search and rescue and supporting firefighting operations in a calculated, controlled and safe manner, *while remaining alert to changing conditions,* during high risk primary search and rescue operations where lives can be saved.

Go in Together, Stay Together, Come Out Together

Objective: To ensure that firefighters always enter a burning building as a team of two or more members and *no firefighter is allowed to be alone at any time* while entering, operating in or exiting a building.

Maintain Continuous Awareness of Your Air Supply, Situation, Location and Fire Conditions

Objective: To cause all firefighters and company officers to maintain constant situational awareness their SCBA air supply, where they are in the building and all that is happening in their area of operations and elsewhere on the fireground that may affect their risk and safety.

Constantly Monitor Fireground Communications for Critical Radio Reports.

Objective: To cause all firefighters and company officers to maintain constant awareness of *all* fireground radio communications on their assigned channel for progress reports, critical messages or other information that may affect their risk and safety.

You Are Required to Report Unsafe Practices or Conditions That Can Harm You. Stop, Evaluate, and Decide.

Objective: To prevent company officers and firefighters from engaging in unsafe practices or exposure to unsafe conditions that can harm them and *allowing any member to raise an alert about a safety concern without penalty* and mandating the supervisor address the question to ensure safe operations.

You Are Required to Abandon Your Position and Retreat Before Deteriorating Conditions Can Harm You.

Objective: To cause firefighters and company officers to be aware of fire conditions and cause an early exit to a safe area when they are exposed to deteriorating conditions, unacceptable risk and a life threatening situation.

Declare a May-Day As Soon As You THINK You Are in Danger

Objective: To ensure the firefighter is comfortable with, and there is no delay in, declaring a May Day when a firefighter is faced with a life threatening situation and the May Day is declared as soon as they THINK they are in trouble.

The Incident Commanders Rules of Engagement for Firefighter Safety

Rapidly Conduct, or Obtain, a 360 Degree Situational Size Up of the Incident

Objective: To cause the incident commander to obtain an early 360 degree survey and risk assessment of the fireground in order to determine the safest approach to tactical operations as part the risk assessment and action plan development *and before firefighters are placed at substantial risk.*

Determine the Occupant Survival Profile.

Objective: To cause the incident commander to consider fire conditions in relation to possible occupant survival of a *rescue event* before committing firefighters to high risk search and rescue operations as part of the initial and ongoing *risk assessment* and action plan development.

Conduct an Initial Risk Assessment and Implement a SAFE ACTION PLAN

Objective: To cause the incident commander to develop a safe action plan by conducting a size-up, assess the occupant survival profile and completing a risk assessment *before* firefighters are placed in high risk positions on the fireground.

If You Do Not Have the Resources to Safely Support and Protect Firefighters, Seriously Consider a Defensive Strategy

Objective: To prevent the commitment of firefighters to high risk tactical objectives that cannot be accomplished safely due to inadequate resources on the scene.

DO NOT Risk Firefighter Lives for Lives or Property That Cannot Be Saved. Seriously Consider a Defensive Strategy.

Objective: To prevent the commitment of firefighters to high risk search and rescue and firefighting operations that may harm them when fire conditions prevent occupant survival and significant or total destruction of the building is inevitable.

Extend LIMITED Risk to Protect SAVABLE Property.

Objective: To cause the incident commander to limit risk exposure to a reasonable, cautious and conservative level when trying to save a building that is believed, following a thorough size up, to be savable.

Extend VIGILANT and MEASURED Risk to Protect and Rescue SAVABLE Lives.

Objective: To cause the incident commander to manage search and rescue, and supporting firefighting operations, in a highly calculated, controlled, and cautious manner, *while remaining alert to changing conditions,* during high risk search and rescue operations where lives can be saved.

Act Upon Reported Unsafe Practices and Conditions That Can Harm Firefighters. Stop, Evaluate and Decide.

Objective: To prevent firefighters and supervisors from engaging in unsafe practices or exposure to unsafe conditions that will harm them and *allowing any member to raise an alert about a safety concern without penalty* and mandating the incident commander and command organization officers promptly address the question to insure safe operations.

Maintain Frequent Two-Way Communications and Keep Interior Crews Informed of Changing Conditions

Objective: To ensure that the incident commander is obtaining frequent progress reports and all interior crews are kept informed of changing fire conditions observed from the exterior by the incident commander, or other command officers, that may affect crew safety.

Obtain Frequent Progress Reports and Revise the Action Plan

Objective: To cause the incident commander, as well as all command organization officers, to obtain frequent progress reports, to continually assess fire conditions and any risk to firefighters, and to regularly adjust and revise the action plan to maintain safe operations.

Ensure Accurate Accountability of Every Firefighter Location and Status

Objective: To cause the incident commander, and command organization officers, to maintain a constant and accurate accountability of the location and status of all firefighters within a small geographic area of accuracy within the hazard zone and aware of who is presently in or out of the building.

If After Completion of the Primary Search, Little or No Progress Towards Fire Control Has Been Achieved, Seriously Consider a Defensive Strategy.

Objective: To cause a benchmark decision point, following completion of the primary search, requiring the incident commander to consciously determine if it's safe to continue offensive interior operations where progress in controlling the fire is not being achieved and there are no lives to be saved.

Always Have a Rapid Intervention Team in Place at All Working Fires.

Objective: To cause the incident commander to have a rapid intervention team in place ready to rescue firefighters at all working fires.

Always Have Firefighter Rehab Services in Place at All Working Fires.

Objective: To ensure all firefighters who endured strenuous physical activity at a working fire are rehabilitated and medically evaluated for continued duty and before being released from the scene.

SECTION FIVE

Explanations

And

Lesson Plans

Rules of Engagement for Firefighter Survival

Introduction and Overview of Explanation of Lesson Plans

The following two sections provide explanation and lesson plan information reflecting the intent and justification of the Rules of Engagement for Firefighter Survival.

In the documents which follow, each of the “bullet” statements of the Rules of Engagement has an objective statement, followed by a narrative explaining the intent of the bullet rule and how it is intended to be applied on the fireground. Also included is a list of teaching points. Each Rule “bullet” statement and “objective” also has at least one National Institute for Occupational Safety and Health (NIOSH) Fire Fighter Fatality Investigation and Prevention Program report assigned to it to further illustrate the purpose of each individual bullet statement. Each report is a summary of the full investigation. A report number is provided that will allow the instructor to obtain more information if desired to expand instruction capability.

Also included with each bullet statement are reports from the National Near-Miss Reporting System with a case number that provide additional supporting case histories for each bullet statement.

The document also has five selected NIOSH fatality investigations as in-depth case histories.

Size-Up Your Tactical Area of Operation.

Objective: To cause the company officer and firefighters to pause for a moment and look over their area of operation and evaluate their *individual* risk exposure and determine a safe approach to completing their assigned tactical objectives.

> **NO GO.** If the assigned objective cannot be achieved because existing conditions or unsafe and prevent success, stop and report the situation to the incident commander and revise the objective and action plan.

Narrative

There has been much discussion in recent years about the need for the incident commander to conduct a 360 degree size-up of the incident. NIOSH firefighter fatality reports repeatedly cite lack of a complete size-up as a contributing factor in firefighter deaths. The company officer and firefighter, by the nature of their work, are the persons at greatest risk during offensive firefighting operations. They are also the people "on location" that can best observe what's happening on their side of the fireground and what the risk may be. These members must conduct a size-up their side of the incident, or operational area, to determine their risk exposure and select the safest approach to achieving objectives assigned by command. If the risk for the objective is unacceptable that decision must be communicated to the incident commander, or supervising command officer, and the objective or action plan must be adjusted to make the situation safer.

There are also a number of critical factors that may apply to the size up of the operational area that may help in determining the risk involved. They include; building size, arrangement and access, fire location and extension, wind speed and direction, ventilation profile, savable lives and property, resources, adequate firefighter staffing and water supply. There are seven sides of the structure which may affect the assigned area of operation; four sides, interior, top and bottom. Monitor radio reports from these other areas may help in determine the effect on the operational area and aid in forecast where the fire is and its current intensity where it may be moving to.

The company officer and firefighters should conduct a rapid, yet deliberate evaluation of fireground factors present. Each side of the fireground has its own unique fire conditions and risk that must be assessed. The company officer and firefighter must avoid lapsing into tunnel vision on the task at hand - such as focusing only on stretching a hoseline up the sidewalk leading to the door. They must take a few seconds to size up the total situation within their line of sight viewing. Firefighters should also understand there are visual factors that are present and other factors not visible. The firefighter must also consider all interior conditions as part of the size up and before entry. They must evaluate what is burning, where it is, and where it's likely to go. Evaluating these factors can allow the firefighter to forecast future conditions and their individual risk.

As part of the size-up it's important that the first company officer, or team leader, to each side of the fireground provide an early progress report to the incident commander. If significant risks are identified, or other important information is observed that will affect safety or the action plan in the operational area, that information must be communicated to the incident commander or other supervising command officer.

Sometimes the firefighters "gut" is also a good indicator of an impending threat. If the size-up looks unsafe, "feels" unsafe, DON'T DO IT! Any firefighter is authorized to communicate a safety concern up, down and across the command organization to have the situation further evaluated.

The firefighter must also continue the size up process upon entry – continuously monitoring conditions and noting the floor layout, isles and hallways, window and doors, etc. that may be used as an emergency exit .

The company officer and firefighter must also closely monitor radio communications for reports related to fire operations as part of their initial an ongoing size-up. Fire conditions, or hazards reported elsewhere on the fireground, may quickly increase risk to firefighters in other operational areas.

Size-up includes matching resources to the assigned objectives – proper sized and number of hose lines, staffing, etc. All hand lines must be charged before entering a burning compartment.

Underwriters also conducted research involving fires in "legacy" homes (of the 1950-1960's) and today's modern homes. The fire in the legacy home took 29 minutes and 25 seconds to reach flashover. Where as in the modern home, **flashover occurred in just 3 minutes and 40 seconds!** This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

Abandoned and dilapidated buildings are a special consideration during size-up for a no-go decision. Where an active and progressing fire is present, a defensive strategy must be seriously considered from the outset.

Lightweight poses increased risk to firefighters because of early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory (UL) tests determined some lightweight unprotected truss systems can collapse as early as 6.5 minutes after flame impingement – and without warning.

Firefighters should also be aware of wind driven fires. Any wind over 10 mph begins to have increasingly dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increasing risk to any firefighters downwind who are in a building. The higher the wind speed the more intense the fire conditions. Once a downwind window fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building firefighters will be subject to a much greater blow torch affect than created by positive pressure ventilation.

Where wind conditions exist firefighters may need to alter the old rule of "attacking fire from the unburned side" and attack the fire from the upwind side.

Bottom line; if the assigned objective cannot be achieved because existing conditions are unsafe and prevent success, stop and communicate the situation to the incident commander and revise the objective.

Teaching Points

- *NIOSH investigation of firefighter fatalities has regularly identified lack of a complete 360 degree fireground assessment by the incident commander as a frequently cited contributing factor in firefighter deaths.*

- *More recently there has been a recognition that firefighters need to conduct their own size up of their assigned operational area as well as conducting their own individual risk assessment of the assignment. Where assigned objectives are determined to be too unsafe, the company officer or firefighter must report that situation to the incident commander.*

- *All firefighters are responsible for their own safety and the safety of other firefighters working with them.*

- *The company officer and firefighters, by the nature of their work, are the persons at greatest risk during offensive firefighting operations. They are also the people "on location" that can best see what's happening in their operational area of the fireground and what the risk may be.*

- *The company officer and firefighter must size-up their side of the fireground, or operational area, <u>to determine their individual risk</u> and select the safest approach to achieving objectives assigned by command.*

- *The company officer and firefighter must not tunnel vision on the task at hand- such as focusing only on the sidewalk leading to the door. It's necessary for members to take a few seconds to size up the situation within line of sight viewing.*

- *The company officer and firefighters should conduct a rapid, yet deliberate evaluation of fireground factors present.*

- *Each side of the fireground has its own unique fire conditions and risk that must be assessed by all members for their assigned positions.*

- *There will be factors that are both visually present and not observable. Evaluating these factors can allow the firefighter to forecast future conditions and risk.*

- *There are also a number of critical factors that may apply to the size up of the operational area that may help in determining the risk involved. They include; building size, arrangement and access, fire location and extension, wind speed and direction, ventilation profile, savable lives and property, resources, adequate firefighter staffing and water supply.*

- *There are seven sides of the structure which may affect the assigned area of operation; four sides, interior, top and bottom. Monitor radio reports from these other areas may help in determine the effect on the operational area and aid in forecast where the fire is and its current intensity where it may be moving to.*

- *Recent research by Underwriters Laboratory's determined that a fire in a modern home (contents of plastics and synthetics) can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.*

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover,* ***the time from onset of untenability to flashover was less than 10 seconds!*** *This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a downwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*
- *The firefighter must consider all interior conditions as part of the size up and before entry.*

- *Firefighters must know what is burning, where it is, and where it's likely to go.*

- *Size up continues upon entry of the building – including noting doors and windows, etc., which will allow the firefighter to quickly find an exit if fire conditions deteriorate.*

- *If significant risks are identified, or other important information is observed that will affect safety or the action plan in their assigned operational area that information must be reported to the incident commander or other supervising command officer.*

- *If the size up looks unsafe, "feels" unsafe, DON'T DO IT! Communicate it up, down and across. Sometimes the gut is a good indicator for a no-go decision.*

- *The company officer and firefighter must also listen closely to their assigned tactical radio channel for reports related to fire operations. Fire conditions, or hazards elsewhere on the fireground, may quickly increase risk to firefighters in their operational areas.*

- *Ongoing progress reporting from company officers or other command organization officers are necessary to keep the incident commander informed and the action plan current.*

- *Resources must match the assigned objectives – proper sized and number of hose lines, staffing, etc. All hoselines must be charged before entering a burning compartment.*

- *Abandoned and dilapidated buildings are a special consideration for a no-go decision. Where an active and progressing fire is present, and the fire is not rapidly knocked down, a defensive strategy should be seriously considered from the outset.*

- *In many cases with dilapidated buildings, fire control can be achieved with high volume apparatus mounted monitors directed from the exterior.*

- *Understand that a building suffering substantial fire which was knocked down may also suffered significant structural damage – which may create a collapse risk. Re-assess before re-entry.*

- *Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which company officers and fire fighters may not have adequately sized-up their tactical area of operation or evaluated their individual risk exposure to determine a safe mode of operation, including:

Career Probationary Fire Fighter and Captain Die as a Result of Rapid Fire Progression in a Wind-Driven Residential Structure Fire – Texas

http:// cdc.gov/niosh/fire/reports/face200911.html

Shortly after midnight on Sunday, April 12, 2009, a 30-year old male career probationary fire fighter and a 50-year old male career captain were killed when they were trapped by rapid fire progression in a wind-driven residential structure fire. The victims were members of the first arriving company and initiated fast attack offensive interior operations through the front entrance. Less than six minutes after arriving on-scene, the victims became disoriented as high winds pushed the rapidly growing fire through the den and living room areas where interior crews were operating. Seven other fire fighters were driven from the structure but the two victims were unable to escape. Rescue operations were immediately initiated but had to be suspended as conditions deteriorated. The victims were located and removed from the structure approximately 40 minutes after they arrived on location.

Key contributing factors identified in this investigation include: **an inadequate size-up prior to committing to tactical operations;** lack of understanding of fire behavior and fire dynamics; fire in a void space burning in a ventilation controlled regime; high winds; uncoordinated tactical operations, in particular fire control and tactical ventilation; failure to protect the means of egress with a backup hose line; inadequate fireground communications; and failure to react appropriately to deteriorating conditions.

Career Fire Fighter Dies After Being Trapped in a Roof Collapse During Overhaul of a Vacant/Abandoned Building—Michigan

http://www.cdc.gov/niosh/fire/pdfs/face200837.pdf

On November 15, 2008, a 38-year-old male fire fighter (the victim) died **after being crushed by a roof collapse in a vacant/abandoned building. Fire fighters initially used a defensive fire attack to extinguish much of the fire showing from the second-floor windows on arrival.** After the initial knockdown, fire crews entered the second floor to perform overhaul operations. During overhaul, the roof collapsed with several fire fighters still inside, on the second floor. The victim and two other fire fighters were trapped under a section of the roof. Crews were able to rescue two fire fighters (who self-extricated), but could not immediately find the victim. After cutting through roofing materials, the victim was located by fire fighters, unconscious and unresponsive. He was removed from the structure and transported to a local hospital where he was pronounced dead.

Career Fire Captain Dies When Trapped by Partial Roof Collapse in a Vacant House Fire - Texas

http://www.cdc.gov/niosh/fire/pdfs/face200509.pdf

On February 19, 2005, a 39-year-old career fire Captain (the victim) **died after being trapped by the partial collapse of the roof of a vacant one-story wood frame dwelling.** The house was abandoned and known by residents in the area to be a "crack house" at the time of the incident. The victim was the captain on the first-arriving engine crew which was assigned to perform a "fast attack" – to take a hoseline into the house, locate the seat of the fire, and begin extinguishment. The one-story wooden ranch-style house was built in the 1950s and additional rooms had been added at the rear in at least two phases following the initial construction. **Crews arriving on scene could see fire venting through the roof at the rear of the house.** The victim and a fire fighter advanced the initial attack line through the front entrance and made their way toward the rear of the house. **Visibility was good in the front of the house but conditions quickly changed as they advanced toward the rear. The fast attack crew had just begun to direct water onto the burning ceiling in the kitchen and den areas when the roof at the rear of the structure (over the building additions) collapsed, trapping the captain under burning debris.** The collapse pushed fire toward the front of the house which quickly ignited carbon and dust particles suspended in the air along with combustible gases, sending a fireball rolling toward the front of the structure. Prior to the time of the collapse, two other crews had entered through the front entrance. The rapidly deteriorating conditions following the collapse quickly engulfed the other crews with fire. Crew members became disoriented and crews became separated as they attempted to find their way out. Five fire fighters received burns requiring medical attention.

Volunteer Fire Lieutenant Killed While Fighting a Basement Fire - Pennsylvania

http://www.cdc.gov/niosh/fire/pdfs/face200808.pdf

On March 5, 2008, a 35-year-old male volunteer Fire Lieutenant (the victim) died while fighting a basement fire. **About 30 minutes after the fire call had been dispatched and the crews had been evacuated from the structure and accounted for, a decision was made to re-enter the structure to try and extinguish the fire.** The victim, an Assistant Chief (AC), and a Captain had made their way down an interior stairway to the basement area where the victim opened a 1 ¾-inch hoseline. Shortly thereafter, the Captain told the AC that he had to exit the basement stairs. A few seconds later, the AC told the victim to shut down the line and evacuate the basement because the fire was intensifying. The AC was second up the stairs and told a fire fighter at the top of the stairway landing that the victim was coming up behind him. The AC exited the structure while the fire fighter stayed at the top of the stairway and yelled several times to the victim, but received no response. The fire fighter exited the structure and informed the AC that the victim had not come up from the basement. The AC then notified the Incident Commander who activated a rapid intervention (RIT) team. The RIT made entry into the structure but was repelled by the intensity of the fire. After several more rescue attempts, the victim was removed from the building and later pronounced dead at the hospital. Four other fire fighters were treated for minor injuries and were released from the hospital. The following factors were identified as contributing

to the incident: an absence of relevant standard operating guidelines; lack of fire fighter team continuity; suboptimal incident command and risk management; and lack of a backup hose line.

Two Career Fire Fighters Die While Making Initial Attack on a Restaurant Fire –Massachusetts

http://www.cdc.gov/niosh/fire/pdfs/face200732.pdf

On August 29, 2007 a 55-year-old male career fire fighter (Victim #1) and a 52-year-old male career fire fighter (Victim #2) died while conducting an interior attack to locate, confine, and extinguish a fire located in the cockloft of a restaurant. Upon arrival, fire was showing through the roof with negligible smoke and heat conditions in the main dining area. Victim #1 was on the nozzle flowing water on the fire in the ceiling area above the exhaust hood and duct work for the stove/broiler in the kitchen. His officer and the officer from the first arriving ladder company provided back-up on the 1 ¾-inch handline. Victim #2 was in the main dining area searching for fire extension above the suspended ceiling. **Approximately five minutes after the first crew arrived on the scene, a rapid fire event occurred.** Victim #1 was separated from his crew and was later found on the handline under debris with trauma to his head. Victim #2 had a lapel microphone with an emergency distress button which sounded a minute after the rapid fire event, likely from fire impingement. He was found in the area of the dining room where he was operating just before the rapid fire event occurred.

NEAR MISS REPORTS

Report #06-111

Our department was called out to a double wide mobile home fire. There were 3 of us that responded. I was Chief at the time. We found the structure involved in the front with flames coming out of the front windows. We charged a 1 3/4" line and began to knock down the fire. We had been in the defense attack mode about 15 minutes, when I decided to walk around to the rear while the two firefighters continued to battle the blaze in front.

At the rear of the structure about 6 ft. from the rear wall, was an 8 ft. propane tank. What we did not know was that the fire had burned through the rear wall and was rapidly heating up the propane tank to the point that the water that had fallen into the valve containment bowl on top of the tank was boiling like a tea kettle. I had no idea why the pressure relief valve had not functioned, but I knew that we were very close to leaving this world. Needless to say we immediately began to forget about the structure and started to cool the tank. At that time I had attended two classes from the state fire academy that amounted to introduction to basic firefighting. However, **my instructors had repeatedly stressed how important it was to do a walk around size-up. I had failed to do that and it almost cost our lives.**

I am now a state Fire Academy certified Level 2 entry firefighter with 23yrs. experience. As Training Officer for our department, I tell our firefighters that unless they have the ability to see through structures, they had better be doing a walk around size-up. In my opinion, one of the most important aspects of any kind of emergency is situational awareness and in that incident I completely lost sight of that. Having looked at the results of the reports that were sent in by other departments' near-miss

incidents, I was stunned to learn that the main contributing factor in the majority of those incidents was the same as our incident, situational awareness.

Report #07-860

My department [Department name deleted] **responded to a mutual aid call for a large multi-unit apartment fire.** This incident was commanded by a neighboring fire department [Department name deleted]. The incident was located in a mixed use area of [City name deleted]. Upon arriving on scene (5-10 minutes after first arriving units) the four man crew from [Name of company deleted] was instructed by the Incident Commander to make entry and advance a hoseline into one of the upstairs burning units. They were instructed to begin attacking the fire in the common attic shared by multiple upstairs apartment units. They took a scuttle hole ladder, pike poles, axes, and a charged hoseline with them and entered the smoke filled unit. Two of us began breaching the ceiling sheetrock with a pike pole and positioned a scuttle hole ladder to access the attic space overhead. The other two personnel had the charged hoseline and worked their way to a large source of smoke coming from a shared wall between the units we were in and the adjacent unit. **The hose team used a second pike pole to open the wall between the units. They found a large volume of fire in the adjacent unit. As the two on the hose team backed up to inform us of the situation, the floor began sagging and cavernously opening up where the floor met the wall adjacent to the burning unit**. **This revealed a large volume of fire in the downstairs unit directly below us.** The officer of our hose team pulled the nozzleman back from the opening in the floor and our interior crew immediately backed out of the apartment. After everyone was safely outside, our team reported the rapidly deteriorating fire conditions to the Incident Commander. We then descended the exterior metal stairs to ground level and pulled our equipment back. As we were performing this task, the Incident Commander gave the order for immediate withdrawal of all interior crews and sounded three blasts on all the air horns. **Approximately two minutes after the evacuation was ordered, the building we were working in collapsed.**

This incident had the potential for a significant loss of life if the interior crews continued working and were not made aware of the rapidly deteriorating conditions. It is my opinion that the Incident Commander could have more fully sized up the extent of the fire. An assessment should have been made regarding the degree in which the ground floor units were involved before ordering teams to make entry into the overhead upstairs units. Despite being "packed up", our somewhat limited visibility, our diminished situational awareness created by our SCBA masks, and our [Manufacturer deleted] hoods, **we should have checked the fire conditions downstairs before proceeding upstairs.**

Report # 09-1146

While returning from a previous incident, the engine spotted light smoke in a residential area. At approximately the same time that they began to report the smoke, the county dispatch rang out a structure assignment to that area. As a result the engine arrived several minutes prior to the next due unit. The structure was a triplex with each unit being approximately 2,500 sq. ft. or 7,500 sq. ft in total. It was built into the side of a grade and entry from the front door placed you on the second floor, leaving you with one floor below and one floor above.

The captain gave a report on conditions that included smoke and fire coming from the roof and all occupants out of the building. **The captain then made the decision to don SCBAs, pull an attack line, and make entry through the front door. A 360 degree survey had not been completed,** nor was any other unit on scene. Upon making entry, the captain reported encountering light smoke at the ceiling level with clear visibility into the structure. He then made the decision to advance the line down a hallway where the captain and fire fighter encountered heavy smoke down to the floor; a second alarm was requested.

At this point, the captain requested ventilation, but no other units were on scene and the department's only truck company has an extended response time into the involved area. The captain and fire fighter continued to advance until they encountered active fire. After a quick knock down, they employed the use of a thermal imager and spotted an additional heat source to their right, down another hallway. They advanced to that position and began fighting fire in the kitchen area.

The second due engine arrived a full 5 minutes and 11 seconds after the initial unit went on scene. The driver of the first arriving engine had already established his own water supply. The second unit was assigned to back up the first due engine. **After making an initial knock down of the fire in the kitchen, the captain realized he had fire below him and that there was an additional level to the building. However, he was not aware of how to access the lower level**. The captain and fire fighter then began to fight the fire from above it.

It was at this point that the captain and fire fighter suffered burns. It is believed that as the crew was fighting the fire windows on the lower level blew out, creating horizontal ventilation contributing to the rapid acceleration of the fire. The crew, being positioned above the fire, resulted in them being exposed to an excessive amount of heat. This resulted in the captain and fire fighter backing out of the building.

The crew was treated at the hospital. The captain returned to duty and completed his shift. The fire fighter did not return that day. Both the captain and fire fighter were wearing all personal protective equipment including hoods. The fire eventually grew to five alarms.

Report#09-1030

Upon walk around, the captain noted the window in the fire room was craze cracked. All windows and doors were intact. Second engine was delayed because they were doing training out of their district. The captain elected to make an offensive interior attack. He had his driver setup the positive pressure fan.

The incident commander arrived and noticed that the crew was entering the structure. The second engine arrived and placed a backup line into service. The incident commander noted that there was no exit vent hole. The driver of the second engine broke the window to the fire room and thick black smoke came out under great pressure (25-30 feet horizontal) the smoke quickly erupted to a ball of flame. Meanwhile the crew inside was trying to open a large window in the kitchen.

I believe that if the kitchen window had been opened prior to the fire room window, the fire ball would have caught the interior crew in a catastrophic flashover. The crew would have been between the vent exit hole and the fire while the positive pressure fan was pumping fresh air to fuel the fire. **Command should have stopped the operation, made a transitional defensive to offensive attack, and waited**

until the structure was properly ventilated and until the backup line was in place before beginning an interior attack.

Determine the Occupant Survival Profile.

Objective: To cause the company officer and firefighter to consider fire conditions in relation to possible occupant survival of a *rescue event* as part of their initial and ongoing *individual risk assessment* and action plan development.

Narrative

One essential component in the size-up process is to determine if any occupants are trapped and can they survive the current and projected fire conditions.

Our goal as firefighters is to save lives. The fire service has a long history of aggressive search and rescue operations as an initial priority of first arriving fire companies. History (and firefighter fatalities) also reflects that firefighters are exposed to the greatest risk of injury and death during primary search and rescue operations. Search efforts must be based on the potential to save lives. A safe and appropriate action plan cannot be accurately developed until we first determine if any occupants are trapped and can survive the fire conditions during the entire *rescue event* (find AND then remove them). If survival is not possible for the entire extraction period, a more cautious approach to fire operations must be taken. Fire control should be obtained before proceeding with the primary and secondary search efforts.

Fire in a building today is not what it was 50 years ago in the days of our forefathers. Today's building contents contain a large array of plastic and synthetic products. When exposed to fire, plastics burn hotter and produce highly toxic gases. For example, a pound of wood, when burned, produces 8,000 British thermal units (Buts'). On the other hand, a pound of plastic can produce 19,900 Btu's when burned. That's nearly three times hotter!

As a result of plastics in our buildings, today's fires are hotter, and flashover occurs quicker than in the past. The human limit for temperature tenability is 212 degrees. Fire models for today's environment reflect that flashover can occur in less than five minutes and reach a temperature of more than 1,100 degrees. On many occasions flashover can occur as the first fire companies are arriving on the scene. In such cases the survivability of any victims in that compartment can be very limited or non-existent.

Underwriters also conducted research involving fires in "legacy" homes (of the 1950-1960's) and today's modern homes. The fire in the legacy home took 29 minutes and 25 seconds to reach flashover. Where as in the modern home (contents of plastics and synthetics), **flashover occurred in just 3 minutes and 40 seconds!**

This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

The affects of carbon monoxide poisoning on a victim is well known to the fire service. With the high levels of plastics in today's buildings, carbon monoxide is produced in very high concentrations and very quickly. As a result, victims die sooner than the past.

What is not as well known, but is an evolving killer for both the victim and firefighters is cyanide poisoning. Where carbon monoxide kills by blocking oxygen absorption in the blood, cyanide kills the body's organs. Literature reflects that a low concentration of 135 ppm of cyanide will kill a person in 30 minutes. At 3,400 ppm it can kill in less than one minute. It is not uncommon for a fire in today's buildings to routinely produce 3,400 ppm of cyanide. Where a victim may be resuscitated from the affects of carbon monoxide poisoning, the victim may not survive the organ damage caused by cyanide poisoning. [1]

The bottom line; victims die quicker today than in the past – yet the fire service continues to employ aggressive search and rescue tactics of years past. And firefighter fatality reports reflect what can happen without a thorough size-up that includes a survivability profile.

An example of the need to apply survivability profiling and risk assessment as part of action plan development for search and rescue operations is found in a 2005 study by the Boston Globe newspaper. The paper examined firefighter fatality reports related to 52 fires that killed 80 firefighters between 1997 and 2004. In only 14 of those 52 incidents was there even a suspicion of trapped occupants. In only 6 of those 52 incidents were people in the building at the time of the fire departments arrival and not one of those 52 fires resulted in a civilian fatality. [2]

What this research suggests is firefighters are dying at fires where there are NO OCCUPANT/VICTIMS in the building. The only Human Beings at risk are firefighters.

The incident commander must factor growing fire conditions, resources on scene (the number of firefighters to control the fire and complete a rescue), and the time needed to complete a rescue into the decision to conduct and support primary search and rescue operations.

The ultimate question to be considered in regard to survival profiling: If a firefighter cannot survive in the toxic environment without SCBA, and the PPE cannot withstand prolonged exposure above 500 degrees, what makes us think an occupant can survive similar conditions?

Search and rescue and the related removal of any trapped victims from the fire building takes time and quiet often these operations are occurring while conditions continue to deteriorate – sometimes rapidly.

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This situation decreases the possibility of victim survivability while increasing risk to firefighters. A search and rescue decision must be balanced against time conditions and resources. In some cases, primary search and rescue operations must be delayed or abandoned because of deteriorating conditions until the fire is controlled.

The incident commander must determine if victims can survive fire conditions individual compartments as part of this evaluation. If there is no potential for survival, the action plan should be based on that determination. For example, a fire in a home in the middle of the night, with fire showing out a rear window, and modest smoke throughout the rest of the building, may allow victim survival in non involved "compartments".

A fire in the same home in the middle of the night, with significant fire showing from windows of several rooms along with dense smoke, under pressure, pushing out nearly all openings may not allow any victims to survive the heat, toxic environment, and the time required to search and remove them. Additionally, a well involved structure will not allow for survival of any victims.

A fire in an apartment building may not allow survival in a well involved apartment (compartment), but the survival profile may be good in the adjacent apartment(s). The action plan should extend search and rescue to the exposure apartments if safe to do so.

The firefighter must also fully understand the resources required for search and rescue and extraction of the victim. Research conducted by the Phoenix and Seattle Fire Departments regarding search and rescue of downed firefighters determined that it took an average of 11-12 firefighters and 19-21 minutes to complete the search and "extraction" from the building. While this research was for a downed firefighter in a large building, it does reflect the realities of the time and resources needed to search, locate, and remove the (civilian) victim from the building. And, it likely will take more than a two-firefighter team to complete.

The firefighter should also be aware of the affects of wind on fire development and intensity. Wind will have a negative effect on occupant survival and any successful rescue. Any wind over 10 mph begins to have increasingly dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increasing risk to any firefighters downwind while in a building. The higher the wind speed the more intense the fire conditions. Once downwind windows fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building firefighters will be subject to a much greater blow torch affect than created by positive pressure ventilation.

Where wind conditions exists firefighters the incident commander may need to alter the old rule of "attacking fire from the unburned side" and attack the fire from the upwind side.

Abandoned and dilapidated buildings are a special consideration during size-up for a no-go decision. Where an active and progressing fire is present, a defensive strategy must be seriously considered from the outset.

This Rule by no means suggests that primary search and rescue operations not be initiated. The Rule does, however, suggest there are fire conditions where the firefighter cannot penetrate and the victim cannot possible survive.

Bottom line; if the firefighters must wear PPE and SCBA to survive a toxic, 1,100 degree environment to rescue a victim, can the victim survive? If the occupant(s) cannot survive the search and *rescue event,* do not commit. Obtain fire control before searching.

Teaching Points

NO GO. If the occupant(s) cannot survive the search AND *rescue event* do not commit. Obtain fire control before searching.

- *Our goal is to save lives. Firefighters are exposed to the greatest risk during primary search and rescue operations. Search efforts must be based on the potential to save lives. No action plan can be accurately developed until we first determine if the occupant can survive the fire conditions before rescuers reach them AND remove them. If survival is not possible, a more cautious approach to fire operations must be taken. Control of the fire should be obtained before proceeding with the primary and secondary search efforts.*

- *The prime factor in survival profiling is based on evaluating fire conditions in individual "compartments" and determining if the victim can survive existing and projected fire conditions for the entire rescue event.*

- *An accurate determination of an occupant survival profile is a critical part of the incident size up and action plan development.*

- *The firefighter, company officer and the incident commander must factor growing fire conditions, resources on scene (the number of firefighters to complete a rescue), and the time to complete a rescue into the decision to conduct and support search and rescue.*

- *Search and rescue and the related removal of any victims from the fire building takes time and the search and rescue efforts most often takes place while conditions continue to deteriorate – sometimes rapidly, thus increasing risk. A search and rescue decision*

must be balanced against time, conditions, risk and occupant survival. In some cases, the search and rescue effort must be abandoned because of deteriorating conditions.

- *Today's fire environment is far more toxic and lethal than the past. Victims die sooner than what occurred a few decades ago. The old primary killer of fire victims was carbon monoxide.*

- *Today, the new killer in smoke is cyanide which is **30 times deadlier** faster than carbon monoxide. Lab test indicate that an environment containing 3,400 ppm of cyanide can kill in less than one minute. It is not unusual for fires to produce 3,400 ppm of cyanide.*

- *These two killers must be considered in occupant survival profiling.*

- *A pound of wood produces 8,000 btu's when burned. A pound of plastic produces 19,900 btu's – nearly three times the amount of heat. As a result of large amounts of plastic in buildings today, fires are hotter and flashover occurs earlier than decades ago.*

- Recent research by Underwriters Laboratory's determined that a fire in a modern home (contents of plastics and synthetics) can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

- The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

- *If there is no potential for survival, the action plan should be based on that determination and the action plan must reduce firefighter risk exposure.*

- *The rescuer must determine if victims can survive <u>individual compartments</u> as part of decision making. Adjacent compartments may allow survival based on less threatening fire conditions.*

- *The ultimate question to be considered in regard to survival profiling: If a firefighter cannot survive in the toxic environment without SCBA, and the PPE cannot withstand prolonged exposure above 500 degrees, what makes us think an occupant can survive similar conditions?*

- *A fire in a home in the middle of the night, with fire showing out a rear window, and modest smoke throughout the rest of the building, may allow victim survival.*

- *A fire in the same home in the middle of the night, with significant fire showing from several windows, and dense smoke under pressure pushing out of openings, may not permit any victims to survive the heat, toxic environment, and the time required to search and remove them .*

- *A well involved structure will not allow for survival of any victims.*

- *A fire in an apartment building may not allow survival in a well involved apartment (compartment), but the survival profile may be good in the adjacent apartment(s). The action plan should extend search and rescue to the exposure apartments if safe to do so.*

- *Firefighters must be constantly aware that search and rescue takes time to complete - the patient may not survive the rescue event in a toxic environment and fire conditions may not improve during the rescue effort. Be cautious and remain on alert.*

- *Research conducted by the Phoenix and Seattle Fire Departments regarding search and rescue of downed firefighters determined that it took an average of 11-12 firefighters and an average of 19-21 minutes to complete the rescue and "extraction" from the building. While this research was for a downed firefighter in large buildings, it does reflect the realities that it will take time to search, then find, and remove the (civilian) victim from the building. And, it likely will take more than a two-firefighter team to complete. Also note, the research was conducted in a "sterile" research environment. Search and rescue efforts conducted under fire conditions, with heat, smoke, debris, and slippery and wet floors can be expected to take longer.*

- *Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likely hood that there are any occupants in the building. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a upwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

- *This Rule does not suggest firefighters should not conduct a primary search, but rather, where fire conditions and the survival profile suggests occupants cannot survival fire control should be obtained first.*

- *In all cases, the firefighter must continually monitor fire conditions and abandon search and rescue efforts if conditions deteriorate and can harm firefighters.*

- *If a Firefighter Cannot Survive in the Toxic Environment Without SCBA, and the PPE Cannot Withstand Prolonged Exposure Above 500 degrees, What Makes You Think an Occupant Can Survive ?*

SUPPORTING RESEARCH

SPECIAL NOTE: In an article titled "Survivability Profiling: Are victims Savable?, published in the December 2009 issue of Fire Engineering magazine, author Captain Stephen Marsar, of the Fire Department of New York cited the following study.

The Boston Globe newspaper, in 2005, examined federal investigation reports of 52 fires that killed 80 firefighters between 1997 and 2004. In only 14 of those 52 incidents was there even a suspicion of trapped occupants. In only 6 of those 52 incidents were people in the building at the time of the fire departments arrival and, once again, not one of those 52 fires resulted in a civilian fatality.

B. Dedman, Fewer Resources, Greater Risk for Firefighters, Boston Globe, January 31, 2005

What this research suggests is firefighters are dying in large numbers at fires where there are NO OCCUPANTS/VICTIMS were in the building. In order to increase firefighter survival, firefighters must seriously evaluate whether any occupants are actually in the building and thoroughly assess their survival profile.

Today's Fires Are Not What Our Fathers Fought

Underwriters Laboratory (UL) recently conducted research regarding the difference between residential homes of the past (legacy homes) and those of today. The research efforts initial goal was to determine the affects of ventilation in modern residential structures. But the research also found that fires develop much faster with today's residential structure (with more plastic contents).

The research involved 15 experiments. A lit candle was placed on a sofa in a room in both types of residential homes. The fire in the legacy home took 29 minutes and 25 seconds to reach flashover. Where as in the modern home, flashover occurred in just 3 minutes and 40 seconds!

This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

Underwriters Laboratories has produced a three minute video regarding the research findings which can be found at;

www.ul.com/global/eng/pages/offerings/industries/buildingmaterials/fire/fire-service/ventilation/

See Appendix A for Supporting Information Related to Occupant Survival

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which fire fighters engaged in high risk operations at structures with minimal value and conditions indicated that occupant survival was unlikely, including:

One Career Fire Fighter/Paramedic Dies and a Part-time Fire Fighter/Paramedic is Injured When Caught in a Residential Structure Flashover – Illinois

NIOSH case number F2010-10

Executive Summary

On March 30, 2010, a 28-year-old male career fire fighter/paramedic (victim) died and a 21-year-old female part-time fire fighter/paramedic was injured when caught in an apparent flashover while operating a hoseline within a residence. Units arrived on scene to find heavy fire conditions at the rear of a house and moderate smoke conditions within the uninvolved areas of

the house. A search and rescue crew had made entry into the house to search for a civilian who was entrapped at the rear of the house. The victim, the injured fire fighter/paramedic, and a third fire fighter made entry into the home with a charged 2 ½ inch hoseline. Thick, black rolling smoke banked down to knee level after the hoseline was advanced 12 feet into the kitchen area. While ventilation activities were occurring, the search and rescue crew observed fire rolling across the ceiling within the smoke. They immediately yelled to the hoseline crew to "get out." The search and rescue crew were able to exit the structure safely, then returned to rescue the injured fire fighter/paramedic first and then the victim. The victim was found wrapped in the 2 ½ inch hoseline that had ruptured and without his facepiece on. He was quickly brought out of the structure, received medical care on scene, and was transported to a local hospital where he was pronounced dead.

Fire companies were notified at dispatch that the elderly subject on medical oxygen supply was in a wheel chair that was on fire.

cdc.gov/niosh/fire/reports/face200004.html

Structure Fire Claims the Lives of Three Career Fire Fighters and Three Children–Iowa

SUMMARY

On December 22, 1999, a 49-year-old Shift Commander (Victim #1) and two Engine Operators, 39 and 29 years of age respectively (Victim #2 and Victim #3), lost their lives while performing search-and-rescue operations at a residential structure fire. At approximately 0823 hours, the three victims and two additional fire fighters cleared the scene of a motor-vehicle incident. One of the fire fighters (Fire Fighter #1) riding on Engine 3, joined the ambulance crew to transport an injured patient to the hospital. At approximately 0824 hours, Central Dispatch was notified of a structure fire with three children possibly trapped inside. At approximately 0825 hours, Central Dispatch notified the fire department, and a Shift Commander and an Engine Operator (Victim #1 and Victim #2) were dispatched to the scene in the Quint (Aerial Truck 2). At 0827 hours, Engine 3 (Lieutenant and Victim #3) responded to the scene. At 0829 hours as Aerial Truck 2 approached the scene, they radioed Central Dispatch, reporting white to dark brown smoke showing from the residence, and requested six additional fire fighters. Aerial Truck 2 arrived on the scene at 0830 hours. The crew of Aerial Truck 2 witnessed a woman and child trapped on the porch roof, and they were informed that three children were trapped inside the house. A police officer who was already on the scene positioned a ladder to the roof and removed the woman and child as **Victim #1 proceeded into the house to perform a search-and-rescue operation**. Engine 3 arrived on the scene shortly after, and the Lieutenant connected a supply line to the hydrant as Victim #3 pulled the Engine into position. The Lieutenant and Victim #3 stretched a

5-inch supply line and connected it to Aerial Truck 2. At approximately 0831 hours, the Chief and Fire Fighter #1 arrived on the scene, and the Chief assumed Incident Command (IC). **(NOTE; Total of 6 firefighters on scene. Four arrived on two apparatus and the fire chief picked one firefighter up at the hospital)** Fire Fighter #1 **pulled a 1½-inch handline off Aerial Truck 2, through the front door and placed it in the front room.** The IC instructed Victim #2 and Victim #3 to don their protective gear and proceed into the house to assist in the search-and-rescue operations. Fire Fighter #1 went back to Aerial Truck 2 to gear up. At this time, **one of the victims removed the first of the three children from the structure, handed the child to a police reserve officer (deceased)** near the front entrance of the structure, and **returned to the structure to continue search-and-rescue operations.** The police reserve officer transported the child to a nearby hospital. The IC charged the handline from Aerial Truck 2 and went to the structure. At this time **one of the victims removed a second child (also deceased).** The IC grabbed the child and began cardiopulmonary resuscitation (CPR). Due to limited personnel on the fireground, the IC directed a police officer on the scene to transport him and the child to the hospital. After donning her gear, **Fire Fighter #1 approached the front door and noticed that the 1½-inch handline (previously stretched) had been burned through and water was free-flowing. It is believed that the three victims were hit with a thermal blast of heat before the handline burned through.** The three victims failed to exit as 12 additional fire fighters arrived on the scene through a call-back method and began fire suppression and search-and-rescue operations. Victim #2 was located, removed, and transported to a nearby hospital, where he was pronounced dead. Victim #1 and Victim #3 were later found and pronounced dead on the scene.

NEAR MISS REPORTS

Report #09-672

A structure fire response was dispatched. Dispatch reported all occupants out of the structure. First units to arrive were a "quint" with driver only and an ambulance, which was returning from another call.

Units arrived with smoke showing from the front (side A). The ambulance crew began to gear up while the quint driver stretched a line to the front door. **Upon doing this, the quint driver was told that a child was unaccounted for. This was relayed to the ambulance crew who decided to make entry. Upon reaching the front door, they were met with fire. The front bay window then blew out.** The crew knocked down the flames and began to enter as not the push the fire through the house. At this time, the crew observed that the living room was on fire and there was smoke throughout the structure. **They began to push on to the hall to do a search for the child. As they made it to the middle of the living room, the ceiling collapsed on the crew. As it came down, it pushed one firefighter back and covered the other firefighter, knocking off his helmet and striking his back and neck.** At this time an engine arrived, driver only, and began a reverse lay to a hydrant. A rescue engine arrived, driver only as well, and an engine from a neighboring city staffed it with four firefighters. The inside crew dug themselves out and checked for injuries. The inside crew had not taken a portable radio with them. Upon exiting the structure, the assisting engine crew entered and searched the residence with an all clear. **The child was then accounted for outside.** The situation was investigated by the fire marshal and overhaul was completed.

The injured firefighter reported the incident to his supervisor who had him evaluated at the local ER. Luckily there were muscular injuries only, with 3 days off work and 1 week light duty.

Report#08-384

Engines [2], [1] and Truck [1] were dispatched to a reported residential structure fire with reported entrapment. **While enroute units were advised that the police department was on scene with confirmed entrapment.** The shift officer then requested that an additional engine be assigned to the box. Engine [3] was immediately dispatched. Knowing that Engine [1] and Truck [1] would arrive shortly after Engine [2] the shift officer ordered Engine [2] to proceed straight in and attempt a rescue. He then ordered Engine [1] to lay in and Truck [1] to advance a 1 3/4" line to protect the search crew. Engine [2]'s crew complied with the order and made entry via the 1st floor front door. **Despite encountering high heat and heavy smoke conditions, they made entry to search for the trapped victims. They advanced up the stairs to the second floor through fire in the stairwell. The crew, faced with deteriorating conditions on the second floor, continued the search. They quickly found two children obviously deceased and correctly decided to leave the victims and continue the search. Conditions began to become untenable as they returned to the hallway.** During these first few moments, the crew from Truck [1] advanced a dry line to the front door. The structure had a front porch with a roof. The crew from Truck [1] stopped on the porch and completed donning of their SCBA and PPE. They called for the line to be charged once they were completely equipped. For reasons not determined, the line was not immediately charged but neither firefighter was willing to leave the line to return to the engine to get it charged.

During this time, the fire flashed over as the crew from Engine [2] proceeded down the second floor hall to the windows that they had observed prior to entering the structure. As Engine [2] bailed out of the front window they were followed by fire, causing damage to their PPE that required one set to be retired from service. The crew from Truck [1] continued to wait for water on the porch while heavy fire vented out of the front door. They remained in place even though their PPE received significant thermal damage. Water was eventually supplied to the line and Truck [1] advanced into the structure making good progress. **The incident went to a 2nd alarm and resulted in the death of three civilians.**

DO NOT Risk Your Life for Lives or Property That Cannot Be Saved.

Objective: To prevent firefighters from engaging in high risk search and rescue and firefighting operations which may harm them when fire conditions prevent occupant survival and significant or total destruction of the building is inevitable.

Narrative

Our goal as firefighters is to save lives. But the incident commander must recognize that we cannot always save a life. If conditions indicate no occupant can survive current and projected fire conditions in the search "compartment" then search and rescue operations should not be extended until the fire is controlled.

The firefighter must also recognize that we cannot always save a building. Those that are lost generally are rebuilt after the fire. No fire attack or building is worth the life of a firefighter. Yet, there are numerous NIOSH firefighter fatality reports citing cases where firefighters were killed while operating in buildings where fire conditions would be clearly defined as defensive fires. Where such conditions exist, a defensive strategy must be seriously considered by the incident commander at the outset of firefighting operations. If interior operations are already underway firefighters must be immediately withdrawn and operate from a safe exterior position. Appropriate large caliber hose streams or monitors from exterior positions should be employed to obtain fire control. The action plan should be to protect firefighters. Firefighters should not extend risk for what is already lost.

Buildings that are lost are often well involved with fire or fire in sections of the building advancing rapidly to take the building. In these cases large caliber hoselines or apparatus mounted monitor streams should be considered to achieve a rapid and safe knockdown of the fire before extending interior operations and search and rescue.

Firefighters must understand that the structural integrity of a well involved building will be compromised. These fire conditions eat away at the buildings structural and can exposé the firefighter to the risk of roof, floor, or total building collapse during later interior operations or overhaul. Structural integrity must be re-assessed before re-assessed.

The Boston Globe newspaper, in 2005, examined federal investigation reports of 52 fires that killed 80 firefighters between 1997 and 2004. In only 14 of those 52 incidents was there even a suspicion of trapped occupants. In only 6 of those 52 incidents were people in the building at the time of the fire departments arrival and, once again, not one of those 52 fires resulted in a civilian fatality.

What this research suggests is firefighters are dying in large numbers at fires where there are NO OCCUPANTS/VICTIMS were in the building. In order to increase firefighter survival, firefighters must seriously evaluate whether any occupants are actually in the building and thoroughly assess their survival profile.

Recent research by Underwriters Laboratory's determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

The firefighter should also understand and be on alert while operating at wind driven fires. Wind will create substantial and rapid fire development and intensity. Any wind over 10 mph begins to have increasingly dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increasing risk to any firefighters downwind while in a building. The higher the wind speed the more intense the fire conditions. Once downwind windows fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building firefighters will be subject to a much greater blow torch affect than created by positive pressure ventilation.

Where wind conditions exists firefighters the incident commander may need to alter the old rule of "attacking fire from the unburned side" and attack the fire from the upwind side.

Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood that there are any occupants in the building. Should there be any active and growing fire in such a building which cannot be <u>immediately</u> controlled then a defensive strategy must be seriously considered at the outset.

Firefighters should also be on alert for possible lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.

Bottom line: If fire conditions prevent an occupant from surviving a rescue event or the fire has, or will, destroy the building, the action plan should protect firefighters.

Teaching Points

NO GO. <u>If fire conditions prevent occupant survivability of any rescue event.</u>

NO GO. If the fire has, or will, destroy the building.

- *All firefighters must recognize that we cannot always save a life.*

- *All firefighters must recognize that we cannot always save a building.*

- *The Boston Globe newspaper, in 2005, examined federal investigation reports of 52 fires that killed 80 firefighters between 1997 and 2004. In only 14 of those 52 incidents was there even a suspicion of trapped occupants. In only 6 of those 52 incidents were people in the building at the time of the fire departments arrival and, once again, not one of those 52 fires resulted in a civilian fatality.*

- What this research suggests is firefighters are dying in large numbers at fires where there are NO OCCUPANTS/VICTIMS were in the building. In order to increase firefighter survival, firefighters must seriously evaluate whether any occupants are actually in the building and thoroughly assess their survival profile.

- *Where both are lost, all that remains is to knock down and extinguish the fire in a safe manner. Buildings that are lost nearly always are re-built.*

- *NIOSH firefighter fatality investigation reports regularly cite incidents where firefighters died where no occupants were in the building or fire conditions did not allow occupant survivability. The only living Human Beings in the building were firefighters.*

- *No building or fire attack is worth the life of a firefighter.*

- *Where conditions indicate no chance for occupant survival, or the building is lost to a well involved fire, firefighters should not extend risk. The action plan should be to protect firefighters and defensive operations must be seriously considered.*

- *Large caliber hoselines or apparatus mounted monitor streams should be considered to achieve a rapid and safe knockdown of the fire before extending interior operations and search and rescue.*

- *Firefighters must understand that the structural integrity of a well involved building will be compromised. Risk must be thoroughly assessed before re-entry.*

- *The firefighter should understand fire eats away at the buildings structural integrity and interior overhaul operations can exposé the firefighter to the risk of roof or floor collapse or other structural collapse. Re-assess the risk.*

- *Defensive exterior operations would be appropriate with large caliber hose streams from the outset to gain fire control.*

- *Recent research by Underwriters Laboratory's determined that a fire in a modern home (contents of plastics and synthetics) can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.*

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover,* ***the time from onset of untenability to flashover was less than 10 seconds!*** *This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.*

- *Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a upwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

- *This Rule does not suggest that no action be taken (including search and rescue). Rather, a more cautious approach must be taken.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which fire fighters engaged in high risk operations at structures with minimal value and conditions indicated that occupant survival was unlikely and the building could not be saved, including:

Restaurant Fire Claims the Life of Two Career Fire Fighters – Texas, McDonalds Restaurant

http://www.cdc.gov/niosh/fire/reports/face200013.html

February 14, 2000, a 44-year-old male and a 30-year-old female, both career fire fighters, died in a restaurant fire. At 0430 hours, Central Dispatch received a call from a civilian who reported that fire was

emitting through the roof of the restaurant. Medic 73 was first to arrive on the scene, followed by Engine 76 (Captain, Fire Apparatus Operator (FAO), and two fire fighters (Victim #1 and Victim #2). **Upon arrival, dispatch was notified by the two companies that there was visible fire emitting through the roof.** The Captain on Engine 76 radioed dispatch reporting that he and his crew were going to complete a "*fast attack*" (enter the structure with a 1¾-inch hoseline and knock down the fire with the water from their engine). Approximately 2 minutes later, Ladder 76 (Captain, FAO, and one fire fighter) arrived on the scene and the Captain assumed Incident Command (IC). After making forcible entry, the victims entered with a 1¾-inch hoseline as their Captain finished donning his gear. Shortly after, the Captain entered the structure, met up with his crew, and then exited the structure to assist with the advancement of their hoseline. Engine 73 (Captain, FAO, and two fire fighters) arrived on the scene and one fire fighter entered the structure with a 1¾-inch hoseline. He stretched the hoseline past the front counter and around a wall in the dining area. The Captain from Engine 76 reentered the structure and followed a hoseline, which he believed the victims were on**. After meeting up with a fire fighter on the end of the line, the Captain exited and reentered the structure a second time. As he followed the line, debris began to fall and there was visible fire throughout the middle section of the kitchen soon after, District 10 (District Chief) arrived, completed a size-up, and assumed command. Due to the heavy fire he observed, he requested all companies convert to a defensive attack and evacuate the structure. At this point the middle roof section (over the kitchen) of the building had collapsed. An interior evacuation took place, and neither of the victims exited.** The IC sent several fire fighters inside to search for the victims. The fire fighters located and removed Victim #1 at 0530 hours. He was then transported to a local hospital where he was pronounced dead. The fire fighters located Victim #2 at 0713 hours, and she was pronounced dead at the scene. The scene was then turned over to the City Fire and Arson Bureau, which declared the incident to be a crime scene due to arson.

Structure Fire Claims the Lives of Three Career Fire Fighters and Three Children – Iowa

http://www.cdc.gov/niosh/fire/pdfs/face200004.pdf

On December 22, 1999, a 49-year-old Shift Commander (Victim #1) and two Engine Operators, 39 and 29 years of age respectively (Victim #2 and Victim #3), lost their lives while performing search-and-rescue operations at a residential structure fire. At approximately 0824 hours, Central Dispatch was notified of a structure fire with three children possibly trapped inside. At approximately 0825 hours, a Shift Commander and an Engine Operator (Victim #1 and Victim #2) were dispatched to the scene. At 0827 hours, Engine 3 (Lieutenant and Victim #3) responded to the scene. Aerial Truck 2 approaching the scene, **reporting via radio that white to dark brown smoke was showing from the residence, and requested six additional fire fighters.** When Aerial Truck 2 arrived on the scene at 0830 hours, Truck 2 witnessed a woman and child trapped on the porch roof, and they were informed that three children were trapped inside the house. Victim #1 proceeded into the house to perform a search-and-rescue operation. Engine 3 arrived on the scene shortly after, and the Lieutenant connected a supply line to the hydrant as Victim #3 pulled the Engine into position. The Lieutenant and Victim #3 stretched a 5-inch supply line and connected it to Aerial Truck 2. At approximately 0831 hours, the Chief and Fire Fighter #1 arrived on the scene, and the Chief assumed Incident Command (IC). At this time, one of the victims removed the first of the three children from the structure, handed the child to a police reserve officer near the front entrance of the structure, and returned to the structure to continue search and-rescue operations. At this time one of the victims removed a second child. The IC grabbed the child and began cardiopulmonary resuscitation (CPR). Due to limited personnel on the fireground, the IC directed a police officer on the scene to transport him and the child to the hospital. After donning her gear, **Fire Fighter #1 approached the front door and noticed that the 1½-inch**

handline (previously stretched) had been burned through and water was free-flowing. It is believed that the three victims were hit with a thermal blast of heat before the handline burned through. The three victims failed to exit as 12 additional fire fighters arrived on the scene began fire suppression and search-and-rescue operations. Victim #2 was located, removed, and transported to a nearby hospital, where he was pronounced dead. Victim #1 and Victim #3 were later found and pronounced dead on the scene.

NOTE: All three children died in this fire

Career Fire Fighter Injured during Rapid Fire Progression in an Abandoned Structure Dies Six Days Later – Georgia

http://www.cdc.gov/niosh/fire/pdfs/face200702.pdf

On November 23, 2006, a 33-year-old male career fire fighter (the victim) was seriously injured during a fire in a single story **abandoned duplex house**. **The victim was working the interior of the structure fire with other crew members for less than a minute when they were ordered to evacuate the structure because of extreme conditions. At about the same time a flashover or flameover occurred; the victim became disoriented and was unable to exit the burning structure.** The victim was rescued approximately 4 minutes later and transported via ambulance to a metropolitan trauma center where **he remained in critical condition for several days in the burn unit before succumbing to his injuries on November 29, 2006.**

Key contributing factors identified in this investigation include an **initial size up not being conducted, a failure to recognize the signs of an impending flashover/flameover as fire fighters entered the structure**, inadequate communication on the fire ground and the possibility that ventilation induced the rapid fire progression. NIOSH investigators concluded that, to minimize the risk of similar occurrences, fire departments should:

Career Battalion Chief and Career Master Fire Fighter Die and Twenty-Nine Career Fire Fighters are Injured during a Five Alarm Church Fire – Pennsylvania

http://www.cdc.gov/niosh/fire/pdfs/face200417.pdf

On March 13, 2004, a 55-year-old male career Battalion Chief (Victim #1) and a 51-year-old male career master fire fighter (Victim #2) were fatally injured during a structural collapse at a church fire. Victim #1 was acting as the Incident Safety Officer and Victim #2 **was performing overhaul, extinguishing remaining hot spots inside the church vestibule when the bell tower collapsed on them and numerous other fire fighters.** Twenty-three fire fighters were injured during the collapse were transported to area hospitals. A back draft occurred earlier in the incident that injured an additional six fire fighters. The collapse victims were extricated from the church vestibule several hours after the collapse. The victims were pronounced dead at the scene.

NEAR MISS REPORTS

Report #06-444

I was assigned the position of Safety Officer on a one and a half story, single family, lightweight wood-frame structure. The first arriving units found a working fire in the attic that was in the process of venting through the roof on the C/D corner. Command assigned three crews the job of attacking the fire, but warned them about the possibility of a collapse hazard in that area. The crews made entry and found that there was no fire or smoke inside the structure and visibility was excellent. The attack crews made their way toward the seat of the fire and began to pull ceiling and hit the fire with an inch and three-quarter line.

As I made my way to the C side of the structure, **I was able to see through a large window into the house and saw that the attack crews were directly under a section of the roof that was severely damaged by fire and in danger of collapsing.** The roof was comprised of 2X4 trusses and wafer board. **I immediately notified command and advised that we pull all crews out.**

As the attack crews were making their way toward the door, they reported that a collapse had occurred. Most of the personnel were caught in a hallway that, though devoid of smoke, suddenly became engulfed in fire. Several members were knocked to the ground, but everyone made it outside. A PAR report was initiated by command to make sure all personnel were accounted for. **It was then discovered that two firefighters had received burns to the back of the neck and ears**. These two were transported immediately to the ER. Both firefighters were wearing full protective equipment including Nomex hoods. One firefighter reported that he had been struck with enough force to dislodge his facemask and hood. At the ER, it was determined that both individuals had received second degree burns.

Report#08-150

As a rescue company, we responded to a structure fire reported to be a working fire. Our departmental policy dictates that a crew of four will divide into two teams. I was the B- Team supervisor and had the responsibility of covering the floor above the fire for search/rescue, ventilation, and fire extension.

Upon our arrival we found a **1 ½ story split level detached home with about 40% involvement** that included quadrant A of the upper level and quadrants A and B of the lower level. We were the third piece to arrive on the scene after a ladder and engine.

As we approached the Alpha side of the building I noticed a hose line going into the lower level that was charged. There was evidence (visible steam) from the outside that water was in fact being applied to the fire on the lower level. I saw members from the ladder company at the bottom of the stairs, thus steering my decision to go up.

My team member and I entered the building and proceeded to the upper floor in the area of the origin of the fire and began our search. We went straight at the top of the stairs through a kitchen and then left into the dining room. My team member and I had good face to face communication while proceeding through these areas.

Once I made it to the outside wall (B side) of the dining area I could hear the fire towards the front of the house. My partner and I began to turn around in an effort to move back through the path we came

to search the Charlie and Delta quadrants, **when a loud rumble occurred and I was dropped to the floor. The ceiling had collapsed due to heavy fire in the cockloft area that we were unaware of. The collapse brought a heavy fire load down when it occurred and there was fire all around.** I yelled for my partner and he responded. The collapse had actually separated us, knocking him into a clear area. He was ok, advising he could make it out via the interior stairs. Once I got my bearing, I noticed a window and began to move the debris quickly as to make a rapid egress because the flames were intensifying.

As I began to make an unassisted egress from the upper floor window, the ladder truck driver ran up to the window with a ladder and placed just below the sill of the window. This ladder placement was a mere coincidence for I had not transmitted any information related to the collapse via the radio at this point. I made my way down the provided ladder notified the IC of the occurrence and recommended the evacuation of the building.

Extend *LIMITED* Risk to Protect SAVABLE Property.

Objective: To cause firefighters to limit risk exposure to a reasonable, cautious and conservative level when trying to save a building.

NO GO. If the building cannot be saved it's a no go. Considerer an exterior defensive strategy.

LIMITED; the point, edge, or line beyond which something cannot or may not proceed. Confined or restricted within certain limits.

Narrative

Limited is defined as; *"the point, edge, or line beyond which something cannot or may not proceed, confined or restricted within certain limits".* In other words there is a limit, or line, beyond which the incident commander may not allow firefighters to be exposed to unsafe fire conditions. If a building can be saved, limited risk and carefully calculated operations should be employed and operations must be continuously monitored to ensure firefighter safety.

The key word in this discussion is "savable". No fire attack or building is worth the life of a firefighter. If conditions worsen and become unsafe during interior operations, other safe approaches must immediately be considered, or crews must be withdrawn from the building in a timely fashion and defensive exterior operations employed. Most buildings lost to fire are rebuilt.

Where the building is deemed savable attack hoselines must be of proper size and number to achieve fire control. There should be adequate staffing to conduct operations. All hoselines entering or approaching a burning building or compartment must be charged and operating with the correct pressures. There must be a secure water supply. In some cases it would be appropriate to use large caliber hoselines, or apparatus mounted monitor devices, operating from the exterior, to quickly knock down fire before crews enter a building.

Interior firefighting operations must be fully supported with adequate resources on scene. The risk must be closely and continually assessed during interior operations. A fire that cannot be controlled quickly will continue to eat away at the buildings structural integrity, weakening it, thus, increasing risk. Lack of control will allow the fire to spread and conditions to deteriorate and increase in intensity.

Recent research by Underwriters Laboratories determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

The firefighter should also understand and be on alert while operating at wind driven fires. Wind will create substantial and rapid fire development and intensity. Any wind over 10 mph begins to have increasingly dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increasing risk to any firefighters downwind while in a building. The higher the wind speed the more intense the fire conditions. Once downwind windows fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building firefighters will be subject to a much greater blow torch affect than created by positive pressure ventilation.

Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.

Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.

Bottom line; No building is worth the life of a firefighter. Risk must be closely and continuously assessed during interior operations.

Teaching Points

- *This rule implies that the building, or part of it, has been determined savable following a thorough size up and risk assessment.*
- *The firefighter must also recognize that we cannot always save a building. Those that are lost are generally rebuilt after the fire.*
- *No fire attack or building is worth the life of a firefighter. If it can be saved, <u>limit firefighter risk to carefully calculated operations.</u>*
- *Large caliber hose lines provide improved fire control and safety for firefighters. In some cases it would be appropriate to use large caliber apparatus mounted monitor devices to quickly knock down fire before crews enter a building*

- *Where hoselines are used for attack, they must be of proper size and number to achieve fire control. All hoselines entering or approaching a burning building or compartment must be charged and operating with the correct pressures.*

- *Firefighting operations must be fully supported with adequate resources on scene and risk must be closely and continually assessed. Fire conditions must be constantly monitored.*

- *"Adequate resources" include the required number and size of attack hoselines, a secure water supply, AND adequate numbers of firefighters.*

- *A fire that cannot be controlled quickly will continue to eat away at the buildings structural integrity, weakening it and increasing risk. Continue to re-assess.*

- *Recent research by Underwriters Laboratories determined that a fire in a modern home (contents of plastics and synthetics) can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.*

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover,* ***the time from onset of untenability to flashover was less than 10 seconds!*** *This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *If conditions deteriorate and become unsafe, crews must be rapidly withdrawn to a safe area and defensive operations implemented.*

- *The risk to firefighters also continues after fire control. All buildings will be structurally compromised to some degree by the fire and a collapse potential will exist during overhaul. The atmosphere will by toxic for some time.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a upwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

- *Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.*

- *Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which firefighters engaged in high risk operations at structures of minimal value and where fire conditions indicated the building could not be saved as a contributing factor to fire fighter LODDs including:

Volunteer Deputy Fire Chief Dies after Falling Through Floor Hole in Residential Structure during Fire Attack—Indiana.

http://www.cdc.gov/niosh/fire/reports/face200624.html

On June 25, 2006, a 34-year-old male volunteer Deputy Fire Chief died after falling through a hole in the 1st floor of a residential structure during a basement fire attack. **The floor system in the 2-year-old 3,200 ft^2 house contained engineered wooden I-Joists covered with plywood sheeting**. The basement was mostly unfinished and the I-Joists were exposed from the bottom. **Little smoke and no fire was visible when fire fighters initially entered the house but conditions rapidly deteriorated.** The victim was working by himself, operating a 1 ¾ inch hand line just inside the front entrance, **when he fell into the basement.** Attempts were made to reach the victim via a 14' roof ladder lowered into the hole, but debris in the basement, fire/smoke conditions, and the angle of the failed floor all disrupted attempts to reach the victim. Approximately 21 minutes elapsed from the time of the initial 911 call reporting the fire until the victim was located. The fire originated in the basement and the I-Joists were almost totally consumed in the area where the floor collapse occurred.

Career Engineer Dies and Fire Fighter Injured After Falling Through Floor While Conducting a Primary Search at a Residential Structure Fire – Wisconsin.

http://www.cdc.gov/niosh/fire/reports/face200626.html

On August 13, 2006 a 55-year-old male career Engineer (victim) died and his partner was injured after falling through the floor at a residential structure fire. *The 5,600 ft^2 was constructed in 1999 and the first floor contained a heated flooring system consisting of a hot water piping system encased in lightweight concrete which was supported by* ***engineered wood I-Joists and trusses****.* ***An*** **engine company was conducting a fast attack on a suspected basement fire,** while a ladder company conducted horizontal ventilation. The victim and his partner were assigned to conduct a primary search on the ground floor. **Smoke made visibility difficult but little heat was detected** as the victim and his partner proceeded to conduct a left hand search. **They sounded the ceramic tile floor and took one crawling step while on their knees. They heard a large crack just before the floor gave way sending them into the fire burning in the unfinished basement.** The victim fell into the room of origin while his partner fell on the other side of a basement door into a hallway. The partner was able to eventually crawl out of a basement window. The victim was recovered the next day. The floor collapsed approximately 8 minutes after the first crews arrived on scene.

SPECIAL NOTE; The above two cases involved large square footage residential building that would be considered commercial buildings in some communities. It's important that resources match the size of the building and conditions

Volunteer Fire Fighter Dies After Falling Through Floor Supported by Engineered Wooden-I Beams at Residential Structure Fire – Tennessee.

http://www.cdc.gov/niosh/fire/reports/face200707.html

On January 26, 2007, a 24-year-old male volunteer fire fighter **died at a residential structure fire after falling through the ground floor that was supported by engineered wood I-beams**. The victim's crew had advanced a hand line approximately 20 feet into the structure with near-zero visibility. They requested ventilation and a thermal imaging camera (TIC) in an attempt to locate and extinguish the fire. **The** victim exited the structure to retrieve the TIC, and **when he returned the floor was spongy as conditions worsened which forced the crew to exit. The victim requested the nozzle and proceeded back into the structure within an arm's distance of one of his crew members who provided back up while he stood in the doorway. Without warning, the floor collapsed sending the victim into the basement.** Crews attempted to rescue the victim from the fully involved basement, but a subsequent collapse of the main floor ceased any rescue attempts. The victim was recovered later that morning.

Partial Roof Collapse in Commercial Structure Fire Claims the Lives of Two Career Fire Fighters – Tennessee.

http://www.cdc.gov/niosh/fire/reports/face200318.html

On June 15, 2003, a 39-year-old male career Lieutenant (Victim #1) and a 39-year-old male career fire fighter (Victim #2) **died while trying to exit a commercial structure following a partial collapse of the roof which was supported by lightweight metal trusses (bar joists**). The victims were part of the initial entry crew searching for the fire and possible entrapment of the store manager. **Both victims were in the back of the store operating a handline on the fire that was rolling overhead above a suspended ceiling. A truck company was pulling ceiling tiles searching for fire extension when a possible backdraft explosion occurred in the void space above the ceiling tiles. Victim #1 called for everyone to back out due to the intense heat, just as the roof system at the rear of the structure began to fail, sending debris down on top of the fire fighters.** Victim #1 and Victim #2 became separated from the other fire fighters and were unable to escape. Crews were able to remove Victim #2 within minutes and transported him to a local hospital where he succumbed to his injuries the following day. Soon after Victim #2 was removed, the rear of the building collapsed preventing further rescue efforts until the fire was brought under control. Victim #1 was recovered approximately 1 ½ hours later.

SPECIAL NOTE: Underwriters Laboratories, with funding from the Department of Homeland Security, has developed an on-line course for fire professionals – "Structural Stability of Engineered Lumber in Fire Conditions" available at their website *http://www.uluniversity.us./*

NEAR MISS REPORTS

Report #09-522

My lieutenant and I made entry into a one-story home of a reported basement fire. We utilized a left hand search as a tactic to locate the basement. For an attack line, we pulled a charged, 200 foot, pre-connect. After making it to the bottom of the stairs, we heard the fire in the direction of the A/B corner which was the corner we had entered the building on the ground floor. There was an insufficient amount of hose to make a direct attack on the fire at this time. My lieutenant attempted to notify command to get us more hose, but was unable to transmit due to increased radio traffic. **The fire in the basement was indicating an impending flashover, and we realized it was time to get out.** We immediately began to retreat from the basement along with the back-up crew. **After ascending the stairs**, we headed towards the A/B corner of the ground floor to exit the building. **I was following my lieutenant and we noticed the floor felt incredibly spongy. As I pushed off with my right leg, I fell through the floor up to my groin.** I was able to remove my leg but was met with fire, pushing from the hole that my foot had just made. I sprayed water from our attack line for about 5 seconds to try to knock the fire down and give the back-up crew a few more seconds to get over the weakened floor and out of the house. Unfortunately, the water had no effect on the fire as it was well into the free-burning stage. **The back-up crew was cut-off and had to look for a secondary egress point. After I exited the building, I immediately notified command that the floor was compromised.** Command cleared all units from the interior and we began a defensive attack on the building. The back-up crew exited the building through a plate glass window on the A-side of the building, one of the members received a cut to the hand.

Report #09-578

Crews had been operating for 2 hours, at a structure fire, in a large manufacturing facility. We were operating in a defensive mode and had been since arrival. My crew was located about fifty feet away from the building on a hill above the building. We were operating a 2-1/2" attack line and having little effect on the fire. The roof and walls were intact in that area of the building. This task was assigned to us by the deputy chief of operations on behalf of command.

I was summoned to meet face-to-face with the battalion chief. The battalion chief was accompanied by an **acting battalion chief and he directed me to move my crew and line closer to the building. He also directed me to open 2 doors,** on the "B-side" of the building, so we could get water directly on the fire.

While attempting to force one of the doors, on the "B-side", the brick and cinder block wall collapsed narrowly missing one crew member who was in the doorway. Crew members that were standing farther back were hit by the bricks. I reported to command that all personnel were okay. **Command was completely unaware that any crew was operating in the collapse zone and had not given any order to open any doors**. The battalion chief that gave the order was not in command and was not assigned as a sector officer. He had been conducting his own 360 of the building when he gave the order.

The post incident critique determined that there had been a collapse zone established by command, but was not marked in accordance with department operating guidelines. Several crews were operating in

the collapse zone including mine, but we were unaware a collapse zone had been established since it had not been communicated via radio.

Extend *Vigilant* and *Measured* Risk to Protect and Rescue SAVABLE Lives.

Objective: To cause firefighters to manage search and rescue and supporting firefighting operations in a calculated, controlled and safe manner, *while remaining alert to changing conditions*, during high risk primary search and rescue operations where lives can be saved.

NO GO. If you do not have the resources to conduct a safe search and rescue or firefighting operations.

VIGILANT. On the alert; watchful. (for changing fire conditions)

MEASURED. Careful; restrained. Calculated; deliberate.

Narrative

The key words are *vigilant* and *measured*. Vigilant is defined as "on the alert and watchful". During search and rescue operations crews must remain alert to changing fire conditions that may increase risk or prevent rescue. Measured is defined as "careful, restrained, calculated and deliberate" - the applications of which must be considered in strategy and tactics during a search and rescue event by both the firefighter and the incident commander.

Being alert and watchful means continually assessing fire conditions throughout the rescue event and is typically referred to as maintaining "situational awareness". Conditions will either be deteriorating or improving. It also means monitoring the radio for reports of conditions occurring elsewhere on the fireground. Worsening conditions observed from the exterior or elsewhere on the fireground can quickly increase the risk to firefighters involved in search operations.

Our goal as firefighters is to save lives. The fire service has a long history of aggressive search and rescue operations as an initial priority of first arriving fire companies. History (and firefighter fatalities) also reflects that firefighters are exposed to the greatest risk of injury and death during primary search and rescue operations. The decision to search must be based on the potential to save lives. A safe and appropriate action plan cannot be accurately developed until we first determine if any occupants are trapped and can survive the fire conditions during the entire *rescue event* (the time to find AND then remove them). If survival is determine to be possible for the entire extraction period a search and rescue operation may be deemed appropriate.

Search and rescue and the removal of the victim takes time. Fire conditions are almost always deteriorating, most often at the outset, thus increasing risk during the initial phases of operations. Firefighters must be constantly aware of changing conditions and balance the risks. Changing conditions may require the search to be abandoned in the middle of the search and crews withdrawn.

Research conducted by the Phoenix and Seattle Fire Departments regarding search and rescue of downed firefighters determined that it took an average of 11-12 firefighters and an average of 19-21 minutes to complete the rescue and "extraction" from the building. While this research was for a

downed firefighter in large buildings, it does reflect the realities of the time and resources needed to search, locate, and then remove the (civilian) victim from the building. And, it likely will take more than a two-firefighter team to complete.

Where it is believed lives can be saved, firefighters may tend to push the safety envelop. Risk may be justified, but must be closely monitored and controlled to a safe level. If fire conditions create too high of a risk, firefighters should be withdrawn to a safe location before they can be harmed.

Rescue operations must also be fully supported with adequate resources and risk must be closely and continually assessed. If resources are inadequate to maintain firefighter safety during search and firefighting operations, other safer approaches should be considered or defensive operations implemented. Large caliber hose lines provide improved fire control and safety for firefighters. In some cases it would be appropriate to use large caliber monitor devices to quickly knock down fire before crews enter a building to conduct search and rescue operations.

Where hoselines are used for attack, they must be of proper size and number to protect the search effort and achieve fire control. All hoselines entering or approaching a burning building or compartment must be charged and operating with the correct pressures. There must be a secure water supply.

Recent research by Underwriters Laboratories determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

The firefighter should also understand and be on alert while operating at wind driven fires. Wind will create substantial and rapid fire development and intensity. Any wind over 10 mph begins to have increasingly dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increasing risk to any firefighters downwind while in a building. The higher the wind speed the more intense the fire conditions. Once downwind windows fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building that hallway the firefighters are in will be subject to a much greater blow torch affect than created by positive pressure ventilation.

Where wind conditions exists firefighters the incident commander may need to alter the old rule of "attacking fire from the unburned side" and attack the fire from the upwind side.

Crews must consider the possibility of lightweight construction and early collapse potential. Underwriters Laboratory test determined some lightweight unprotected truss can collapse in 6.5 minutes after flame impingement – and without warning. In some situations, collapse could occur as firefighters are arriving on scene and starting operations.

Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.

Bottom line; During search efforts, both the firefighter and incident commander must maintain situational awareness of changing fire conditions, surroundings, and what's happening elsewhere on the fireground to ensure safe search operations.

Teaching Points

- *Our goal is to save lives. Where the survival profile indicates lives may be saved, risk may be justified – BUT, search and rescue operations should be applied in a very calculated manner while being alert and watchful for changing conditions that may put firefighters at risk.*

- *Rescue operations must be fully supported with adequate resources and risk must be closely and continually assessed. "Adequate resources" include the required number and size of attack hoselines, a secure water supply, AND adequate numbers of firefighters.*

- *Firefighters and company officers must recognize that search and rescue is most often conducted where conditions are deteriorating, and before hoseline crews can obtain fire control.*

- *Firefighters and company officers, by nature of their work, are exposed to the greatest risk during search and rescue operations. These operations often occur prior to fire control and frequently during deteriorating conditions.*

- *Recent research by Underwriters Laboratories determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.*

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover,* ***the time from onset of untenability to flashover was less than 10***

seconds! *This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *Where it is believed lives can be saved, firefighters may tend to push the safety envelop. The risk may be justified, but must be closely monitored and controlled in a safe manner. If deteriorating conditions present too high of risk, search and rescue operations should be terminated and firefighters should be withdraw*

- *If resources are inadequate to maintain firefighter safety during search and firefighting operations, consider other safe approaches or implement defensive operations.*

- *Large caliber hose lines provide improved fire control and safety for firefighters. In some cases it would be appropriate to use large caliber apparatus mounted monitor devices to quickly knock down fire before crews enter a building to conduct search and rescue operations.*

- *Where hoselines are used for attack, they must be of proper size and number to achieve fire control. All hoselines entering or approaching a burning building or compartment must be charged and operating with the correct pressures. There must be a secure water supply.*

- *Search and rescue and the extraction of the victim takes time and resources. Fire conditions are almost always deteriorating in the early stages of the search, thus increasing risk. Firefighters must be constantly aware of changing conditions and balance the risks. Changing conditions may require the search to be abandoned in the middle of the search.*

- *Research conducted by the Phoenix and Seattle fire departments in buildings of approximately 5,000 square feet determined that an average of 11–12 members were required to rescue a downed firefighter. Additionally, it took an average of 19-21 minutes to complete a rescue and extract the victim.*

- *This research was conducted under a "sterile' conditions. Search and rescue during an active fire with heat, smoke, debris, and wet floor and slippery conditions search and rescue can be expected to take longer.*

- *Firefighter rescue is also risky. Research by the Phoenix Fire Department found that one in five rescuers tended to get disoriented and got in trouble during simulated RIT operations. This could be life threatening to a lost RIT member.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a downwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

- *Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly a floor over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.*

- *Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which primary search and rescue operations may not have been carried out in a vigilant , measured, calculated, controlled, and safe manner, including:

A Career Captain and an Engineer Die While Conducting a Primary Search at a Residential Structure Fire – California

http://www.cdc.gov/niosh/fire/pdfs/face200728.pdf

On July 21, 2007, a 34-year-old career captain and a 37-year-old engineer (riding in the fire fighter position) died while conducting a primary search for two trapped civilians at a residential structure fire. The two victims were members of the first arriving crew. **They made a fast attack and quickly knocked down the visible fire in the living room.** They requested vertical ventilation, grabbed a thermal imaging camera, and made re-entry without a handline to search for the two residents known to be inside. Another crew entered without a handline and began a search for the two residents in the kitchen area. A positive pressure ventilation fan was set at the front door to increase visibility for the search teams. **The second crew found and was removing one of the civilian victims from the kitchen area as rollover was observed extending from the hallway into the living room**. Fire fighters became concerned for the air supply of both victims who were still in the structure. Crews conducted a search for the victims and found them in a back bedroom where they had been overcome by the rapid fire event.

Career Fire Fighter Dies and Captain is Injured During a Civilian Rescue Attempt at a Residential Structure Fire – Georgia

http://www.cdc.gov/niosh/fire/reports/face200716.html

On May 28, 2007, a 41-year-old male career fire fighter (the victim) **died after becoming disoriented and falling down a set of stairs while searching for a missing male occupant at a residential structure fire.** A fire captain also received second degree burns resulting in lost-time from work. Both the victim and the captain were members of the first-responding fast attack engine company. After becoming disoriented, they were trapped and missing for several minutes before being found. The fire was reported at approximately 0449 hours. The first arriving fire fighters, including

the victim, arrived on the scene at 0459 hours and were on-scene 13 minutes when the first mayday was called. **The male resident also perished in the fire.**

NEAR MISS REPORTS

Report#07-789

Responding to a residential structure fire, **my crew was given the assignment of performing a primary search.** Fire attack had already been assigned to another crew. My officer assumed command while my crew member and I started with our task. **The attack crew encountered heavy fire and heat shortly inside the front door off to the right.** We started a left hand search covering approximately two rooms. **At this point, the attack crew advised command that they had found a hole in** the floor and command relayed this information to all units on the scene. Stopping to check with my partner to make sure we were still together, I turned to resume our search. **As soon as I started forward, I found myself falling about ten feet into the basement.** The area in which I fell turned out to be the main area of fire involvement. My first actions were to collect myself and to get my face piece repositioned properly as it had dislodged partially. **Surrounded by debris and fire, I had to get into a position to facilitate me communicating on the radio**. My crew member stuck an axe handle in the hole for me to feel, which gave me comfort in knowing someone was with me. I tried to follow our department's standard operating procedures as best I could while trying to maintain calmness. **I notified command of my unit identification, what had occurred, and my physical status. Upon command acknowledging my situation, I then operated my PASS device in short bursts to allow crews to locate me as well as me being able to communicate verbally. The attack crew was at this same hole but in a different location.** It should be noted, the "hole" was about 8' X 12' in size. The nozzle man had partially fallen into the hole but was pulled back by his crew. Being in their position, they were able to knock fire down around me once they realized I had fallen. Command had advised RIC to go in and assist the downed firefighter, another crew entered with a thermal imaging camera. The crew with the camera was able to find my exact location. With that, an attic ladder was called for and I was able to climb out of the basement. I was fortunate that I was able to come away from this incident with some strains, bumps, and bruises.

Report#09-1081

Brackets [] denote reviewer de-identification.
Engine [1] was alerted to a structure fire on [name deleted]. I was riding up as the officer that evening and upon arrival we found a wood frame residential building with a working fire on the Alpha/Bravo corner of the structure. I passed on command as a Chief Officer arrived and assumed a fire suppression role. **My crew stretched a 1 ¾" attack line to the front door with zero visibility inside the structure and as I was masking up on the front steps. I laid my gloves just on the inside of the doorway and when I finished masking up, I reached for my gloves and they were gone. I did not know that we had a fully involved basement fire and the fire had already burned out the main floor my crew was preparing to enter.** Engine [1] then took a defensive mode and extinguished the fire from the exterior.

Go in Together, Stay Together, Come Out Together

Objective: To ensure that firefighters always enter a burning building as a team of two or more members and *no firefighter is allowed to be alone* at any time while entering, operating in or exiting a building.

Narrative

NIOSH Firefighter Line of Duty Death (LODD) reports are riddled with fatalities due to a firefighter separation from partners or crew members, by a single firefighter freelancing and entering a structure alone, and by a single firefighter leaving his partner or crew to exit alone when he is low on SCBA air supply.

A critical element for firefighter survival is crew integrity. Crew integrity means firefighters stay together as a team of two or more. They must enter a structure together and remain together at all times while in the interior, and **all** members come out together**.** No firefighter shall be allowed to be alone at any time while in a burning structure. **Period!**

It is an individual responsibility of every firefighter to stay connected with his partner or crew members at all times. Freelancing by any member must be strictly prohibited. Additionally, crews or buddy teams must never freelance. All firefighters must be operating under the direction of the incident commander, or division/group supervisor or their company officer/lead buddy team member at all times.

The ultimate responsibility for crew integrity and ensuring no members get separated or lost rests with the company officer or lead buddy team member. They must maintain in constant contact with their assigned members by voice, touch or visual observation while in the hazard zone. They must ensure their team stays together. If any of these elements are not adhered to, crew integrity is lost and firefighters are placed at great risk.

If a firefighter becomes separated and cannot get re-connected with his partner immediately he must get on the radio and attempt to communicate with his company officer or partner. If re-connection is not accomplished after three radio attempts or re-connection does not take place within one minute a May Day should be declared (if conditions are rapidly deteriorating the May Day must be declared immediately). As part of a May Day declaration, the firefighter must next activate the radio's emergency alert button (where provided) followed by manually turning on the PASS alarm. (NOTE; some departments may require the emergency button to be activated before declaring a May Day). It's critically important that there is no delay in declaring a May Day – a one minute delay can be life threatening. If the firefighter gets reconnected before a RIT arrives, the May Day can be cancelled. (See "Declared a May Day as Soon as You Think You Are in Trouble" later in this Section).

Similarly, if the company officer or the firefighter's partner recognizes they have a separated member he must immediately attempt to locate the member by using his radio or yelling. If contact is not established after three attempts or within one minute a May Day must be declared immediately.

The hoseline is the firefighter's life line to the exit and firefighters should stay attached to the line and use it as an anchor point while operating in the interior of a structure. Firefighters not utilizing a hoseline should utilize a rope lifeline, particularly when operating in large square foot buildings.

Crew integrity is also essential to fireground accountability. All firefighting operations must be conducted under a recognized firefighter accountability system. A key component of a recognized accountability system includes a tag or passports (with crew names) that are turned in to an accountability officer at the point of entry. The system must also be able to identify the location of assigned crews within a small geographic area of the incident scene. A true accountability system must have the capability of always knowing who is in the building and who is not and be able to identify when a firefighter is delayed or missing. All accountability must be managed at the point of entry in order to maintain continual awareness of who's in or out of the hazard zone. (NOTE; Tags or passports collected only at the command post cannot maintain awareness of who's in or out of the building and is not an accountability system. (It's just a list of potential fatalities)

Bottom line; if the firefighter doesn't have a partner he should never be allowed to enter a burning building.

Teaching Points

NO GO. If you don't have a partner, never enter a burning building

- *Line of Duty Death (LODD) reports are riddled with firefighter fatalities due to a firefighter separation from partners or crew members, by a single firefighter freelancing alone, and by a single firefighter leaving his partner or crew to exit alone when he is low on SCBA air supply.*

- *Any firefighter operating alone in a structural has lost his/her support system. History has shown this to be a killer.*

- *A critical element for firefighter survival is crew integrity. Crew integrity means firefighters go on together, they stay together at all times on the interior, and **all** come out together**. Period!***

- *No firefighter shall be allowed to be alone at any time while in a burning structure.* ***Period!***

- *It is an individual responsibility of every firefighter to stay connected with his partner or crew members at all times.*

- *<u>Freelancing by any member must be strictly prohibited</u>. Additionally, crews or buddy teams must never freelance. All firefighters must be operating under the direction and awareness of the incident commander, or division/group supervisor, or their company officer/lead buddy team member at all times.*

- *It is the responsibility of firefighters to also comply with the fireground accountability system.*

- *The ultimate responsibility for crew integrity and ensuring no members become separated or lost rests with the company officer or lead buddy team member.*

- *The company officer or team leader must maintain constant contact with assigned members by voice, touch or visual senses while in the hazard zone. If these elements are lost, so is crew integrity, and firefighters are placed at great risk.*

- *If a firefighter becomes separated and cannot get re-connected with his partner immediately he must get on the radio and attempt to communicate with his company officer or partner. If re-connection is not accomplished with three radio attempts or re-connection is not established within one minute a May Day should be declared. Rapidly deteriorating conditions may require a May Day to be declared much earlier. The firefighter must next activate the radio's emergency alert button followed by manually turning on the PASS alarm. (NOTE; some departments may require the emergency button to be activated before declaring a May Day). Do not delay a May Day if fire conditions are deteriorating –a one minute delay with deteriorating conditions can be life threatening. If the firefighter is able to reconnect before a RIT arrives, the May Day can be cancelled.*

- *The hoseline, or rope safety line, is the firefighter's life line to the exit. Members must stay on a line at all times.*

- *Crew integrity is also essential to fireground accountability. All firefighting operations must be conducted under a recognized firefighter accountability system.*

- *Key components of a recognized accountability system includes tag or passports (with crew names) that are turned in to an accountability officer <u>at the point of entry</u>, and the system must be able to identify the location of assigned crews within a small geographic area of the incident scene. A true accountability system must have the capability to always know who is in the building and who is not and be able to identify when a*

firefighter is delayed or missing. All accountability must be managed at the point of entry in order to maintain continual awareness of who's in or out. NOTE; Tags or passports collected at the command post cannot determine who's in or out and is not a system. It's just a list of potential fatalities.

- *It is the responsibility of every firefighter to comply with the accountability system and ensure that the accountability officer is aware of all firefighter locations.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which the lack of crew integrity (Go in together, Stay Together, and Go Out Together) was a contributing factor to fire fighter LODDs including:

Volunteer Deputy Fire Chief Dies after Falling Through Floor Hole in Residential Structure during Fire Attack—Indiana.

http://www.cdc.gov/niosh/fire/reports/face200624.html

On June 25, 2006, a 34-year-old male volunteer Deputy Fire Chief died after falling through a hole in the 1st floor of a residential structure during a basement fire attack. The floor system in the 2-year-old 3,200 ft^2 house contained engineered wooden I-Joists covered with plywood sheeting. The basement was mostly unfinished and the I-Joists were exposed from the bottom. Little smoke and no fire was visible when fire fighters initially entered the house but conditions rapidly deteriorated. **The victim was working by himself, operating a 1 ¾ inch hand line just inside the front entrance, when he fell into the basement**. Attempts were made to reach the victim via a 14' roof ladder lowered into the hole, but debris in the basement, fire/smoke conditions, and the angle of the failed floor all disrupted attempts to reach the victim. Approximately 21 minutes elapsed from the time of the initial 911 call reporting the fire until the victim was located. The fire originated in the basement and the I-Joists were almost totally consumed in the area where the floor collapse occurred.

Two Career Fire Fighters Die and Captain is Burned When Trapped during Fire Suppression Operations at a Millwork Facility – North Carolina

http://www.cdc.gov/niosh/fire/pdfs/face200807.pdf

On March 7, 2008, two male career fire fighters, aged 40 and 19 (Victims #1 and #2 respectively) were killed when they were trapped by rapidly deteriorating fire conditions inside a millwork facility in North Carolina. The captain of the hoseline crew was also injured, receiving serious burn injuries. The victims were members of a crew of four fire fighters operating a hoseline protecting a firewall in an attempt to contain the fire to the burning office area and keep it from spreading into the production and warehouse areas. . **The crew separated when a fire fighter ran low on air and followed the hoseline to the outside. The captain attempted to radio for assistance as the conditions deteriorated but fire**

fighters on the outside did not initially hear his Mayday. **The captain sent a second fire fighter (Victim # 2) outside to relay information about their condition. Victim # 2 talked with the Incident Safety Officer, and then returned to re-join his crew.** Once it was realized that the crew was in trouble, multiple rescue attempts were made into the burning warehouse in an effort to reach the trapped crew as conditions deteriorated further. Three members of a rapid intervention team (RIT) were hurt rescuing the injured captain. Victim #1 was located and removed during the fifth rescue attempt. Victim #2 could not be reached until the fire was brought under control. The fourth crew member had safely exited the burning warehouse prior to the deteriorating conditions that trapped his fellow crew members. Key contributing factors identified in this investigation include radio communication problems (unintelligible transmissions in and out of the fire structure that may have led to misunderstanding of operational fireground communications), inadequate size up and incomplete pre-plan information, a deep-seated fire burning within the floor of the office area that was able to spread into the production and warehouse facility, the procedures used in which operational modes were repeatedly changed from offensive to defensive, **lack of crew integrity at a critical moment in the event,** and weather which restricted fireground visibility.

Volunteer Fire Fighter Dies While Lost in Residential Structure Fire-Alabama

http://www.cdc.gov/niosh/fire/pdfs/face200834.pdf

On October 29, 2008, a 24-year old male volunteer fire fighter (the victim) was fatally injured while fighting a residential structure fire. **The victim, one of three fire fighters on scene, entered the residential structure by himself through a carport door with a partially charged 1½-in hose line; he became lost in thick black smoke.** The victim radioed individuals on the fireground to get him out. Fire fighters were unable to locate the victim after he entered the structure which became engulfed in flames. The victim was caught in a flashover and was unable to escape the fire. Approximately an hour after the victim entered the structure alone, a police officer looking through the kitchen window noticed the victim's hand resting on a kitchen counter; the victim was nine feet from the carport door he had entered. The victim was removed from the structure and pronounced dead at the scene by emergency medical services. Key contributing factors identified in this investigation include: fire fighters entering a structure fire without adequate training, insufficient manpower, and lack of an established incident command system.

Career Fire Fighter Dies of Carbon Monoxide Poisoning after Becoming Lost While Searching for the Seat of a Fire in Warehouse - New York

http://www.cdc.gov/niosh/fire/pdfs/face200404.pdf

On December 16, 2003, a 30-year-old male **fire fighter died after he became separated from his crew members** while searching for the seat of a fire at a furniture warehouse. His crew exited due to worsening conditions and a missing member announcement was made. At one point while inside the

warehouse, members of an engine crew thought they heard a scream but could not identify the source. After an evacuation order was given and as engine crew members were exiting, **the victim's officer mistakenly identified one of them as the missing member and cancelled the emergency message**. Once fire fighters had exited, a personnel accountability report (PAR) was taken several minutes later on the street which revealed that the victim was still missing. The victim's officer initiated a second emergency message for a missing member and a search was begun. The victim, who had a working radio, was found lying face down with his face piece removed and 900 psi left in his self-contained breathing apparatus (SCBA). His Personal Alert Safety System (PASS) alarm was reported by fire fighters to be inaudible. His carboxyhemoglobin (COHb) level was 74.8% in the emergency room. The victim did not declare a May Day and did not activate his radios emergency activation button.

NEAR MISS REPORTS

Report#10-287

We responded to a request for mutual aid to block fire in a small rural community. The company officer separated from the crew to "check things out." An evacuation signal was heard due to side "A" wall shift. The crew withdrew, but did not see the officer. The crew called by radio repeatedly to the officer with no response. The crew spontaneously acted to re-enter to find the officer. Just before entry, side "C" reported the officer was safe. As we pulled back, the side "A" brick, 3 story wall came down. Had we continued our entry, we would have become statistics.

Report #06-055

Arriving on a truck company as the driver/operator, with only staffing of two firefighters, I was assigned to perform horizontal ventilation on the uninvolved portion of the structure. The acting officer was assigned to assist the attack crew. The structure was a vacant and unfurnished dwelling. The floor plan was split from the entry way and an interior fire attack crew was operating on the west side of the split floor plan. **I was ordered by the incident commander to enter the east side of the floor plan and perform ventilation of the interior windows. I had no radio and was alone on this assignment**. After entering the east side of the structure with full PPE and positive pressure SCBA, **I walked about 20 feet and fell through the floor from a floor collapse. I was unable to call for assistance and was trapped in the collapse of the floorboards for approximately 10 minutes.** Another team member came in to find me and assisted me out of the broken floor boards. We exited the structure together. There were heavy smoke conditions but no fire involvement on the east side of the structure.

Report#06-245

Working fire in a 3 story wood frame, balloon construction. Building is 28 feet wide by 38 feet deep. **First due engine reported the fire in the first floor rear bathroom had spread to the second and third floors through the walls. Heavy smoke venting from the gable end vents of the house on the "A" and "C" sides.**

Engine crew, officer and 2 fire fighters, operating on the third floor, opening the walls and attempting to cut off extension. **IC requested that I enter the third floor to assist the hose crew and give him a situation report**. Rather than go to the rear of the building and follow the hose line, I climbed the front exterior stair case and forced entry into the third floor apartment. I could hear the hose team from the doorway. I experienced some delay in entering the room because a chair had been placed against the door. I entered the room at the same time the truck company pushed the ceiling down from the vent hole. I proceeded towards the sounds of the engine crew while calling out for them. **Unknown to me at the time, the crew had retreated the way they entered as the attic flashed over**. **The visibility was zero and it was pretty hot**. **I followed the wall on the right in an attempt the reach the hose crew. About half way in I realized they were no longer on the floor.** I hesitated for a few seconds, should I continue towards the rear of the building or reverse and head back to way I came? I had a radio, but never called a mayday or urgent. I decided to continue and found the rear door about one minute later. I exited the building down the rear stairs.

Report #08-393

Our fire company responded mutual aid for a reported structure fire involving a single family dwelling in a neighboring district**. The occupants had exited the building and were accounted for upon arrival of the first officer.** On arrival, the engine in which I was riding had to pass in front of the building and **I commented to the crew on board that we would not be conducting interior operations due to the amount of fire throughout the building.** I reported into the IC and my crew of 5 was given an assignment to stretch a 2-1/2 inch hand line to the rear of the building (C) and apply water in the area of the rear deck/kitchen. The host fire department was in the process of stretching handlines in the front of the building and applying water through openings in the garage (D) and the area of the front door (A). At this point a water supply with tankers was being established, but all attack lines were still being operated on booster tank water. A RIT team was also enroute from two neighboring departments.

While working with my crew in the rear of the fire building, I looked up into the kitchen area through the double sliding doors that opened onto the rear deck. **There in the middle of the fully involved kitchen area was a single firefighter (from the host department) in full PPE, standing fully upright with flames above him at the ceiling level and behind him in the kitchen cabinets.** He then called out to my crew, wanting to use the 2-1/2 inch handline we were operating. He indicated that "he could hit it from his position". When the disbelief wore off after a few seconds, I immediately ordered the firefighter to leave the building. He balked at first, claiming again that he could make a difference by applying water from his position in the fully involved kitchen. At this point, I even more forcefully ordered him from the building. He then exited the building via the front door, opposite our position.

I then transferred command of my crew to a lieutenant on the crew and went in search of the IC to report the episode to him.

Maintain Continuous Awareness of Your Air Supply, Situation, Location and Fire Conditions.

Objective: To cause all firefighters and company officers to maintain constant situational awareness their SCBA air supply and where they are in the building as well as all that is happening in their area of operations and elsewhere on the fireground that may affect their risk and safety.

NO GO. If you don't have a full SCBA bottle.

NO GO. If you don't know your air supply all the times.

NO GO. If you don't know where you are at all times, don't continue. Stop, reorient or report.

NO GO. If you've reached your turnaround point on your SCBA air supply – exit the building.

NEVER RUN OUT OF AIR IN A BUILDING! If you do you will have a very narrow window of survivability!

Narrative

Operating in the interior of a burning building is extremely hazardous. NIOSH firefighter fatality reports frequently describe firefighters running out of air, getting caught in rapidly deteriorating fire conditions, and getting lost in the building as major factors in their deaths.

The SCBA air supply is the firefighter's life support system and they must always confirm a full bottle before entering a burning structure and constantly be aware of their air supply while in the building. They must know when they have reached the turnaround point. It should be mandatory that firefighters plan on exiting before the low air alarm activates. (NFPA 1404).

The firefighter must conduct a thorough and detailed checkout of their assigned SCBA at the start of each shift. The checkout must comply with NFPA 1852 to confirm the SCBA is fully functional (NFPA 1852). Further, any malfunction, before entry or while in the building, must require an immediate exit from the building.

Firefighters must frequently check their air supply while in the structure. Major benchmarks for checking air supply are before entry and after going up or down stairs, before entering and searching a room, after exiting a room, after going down a hall way or isle and before and after doing a labor demanding task.

The air consumption during laborious tasks can be more than double the *old* "minute" rating system for SCBA bottles. (The old" 30 minute" bottle rating can be consumed in 15 minutes or less). It is wise that all firefighters have knowledge of their individual air consumption rate. Additionally, the company officer must know the projected consumption rate of crew members in order to plan a scheduled exit.

Firefighters must provide frequent air supply status reports to their company officer. The company officer should include the lowest air supply status as part of progress reports to the incident commander or the division or group officer.

Air supply status reports improve the logistical commitment of crews. With these reports the incident commander will have early awareness of the approaching need for a fresh crew – as compared to getting surprised as the crew announces its exit from a position because they are running out of air. With on-going of air supply status reports, the incident commander can call fresh crews up from staging and conduct a transition at the operating position instead of at the door after exit.

The National Near Miss Reporting System lists **"Situational Awareness"** as the most commonly reported cause for a life threatening near miss event. Situational awareness is defined as; the level of understanding and attentiveness one has (*the firefighter*) regarding the reality of a set of conditions (*fire conditions and fireground operations*). When situational awareness is high, there are rarely surprises. When situational awareness is low or absent, "*unexpected*" events occur (*that can injure or kill firefighters)*. Simply put, situational awareness is the relationship between what one perceives is happening and what is really happening. **Pay attention to <u>what's really happening!</u>**

The factors which affect situational awareness can be broken down into three divisions: a lack of information (i.e. knowledge of the building contents/layout), lack knowledge (inadequate training) and a lack of cognition (not understanding what's happening). These three divisions are made up of their own unique factors, including misinterpreting conditions and surroundings, not recognizing factors and cues, gathering of incomplete information, being narrow focused and being impaired.

Every firefighter must observe or otherwise be aware of his surroundings, landmarks, windows, exits, and route he takes when penetrating the building. These are important landmarks for self survival if the firefighter becomes separated or lost. These keys items become critical when facing a life threatening emergency and the firefighter's ability to safely exit the building. Additionally, the more detailed and accurate the location description, or landmarks, provided when calling a May Day, the faster a RIT can reach a firefighter.

All firefighters, for basic survival, must maintain constant awareness of their surroundings. Conditions early on in the fire attack may be out of control, placing the firefighter at continued risk. Even after the fire is controlled, the buildings structural integrity has been compromised- sometimes considerably. Situation awareness also includes monitoring all radio communications on their assigned radio channel. Worsening conditions elsewhere on the fireground can quickly result in unsafe conditions for firefighters at other locations. Firefighters must be aware of their work environment and in control of their actions – **ALL THE TIME!**

Teaching Points

- *The firefighter is nearly always to point person working in the area of greatest risk. Operating in a toxic is extremely hazardous and the firefighter must NEVER breathe*

smoke. Lose of SCBA air supply in a burning building can very quickly be lethal for the firefighter

- *The **SCBA air supply is the firefighter's life support system** and firefighters must constantly be aware of how much air they are consuming and when they have reached the turnaround point. Firefighters should always plan on exiting before the low air alarm activates (NFPA 1404). Obtain, it takes longer to exit the building than it took to penetrate to the operating position.*

- The firefighter must conducted a detailed checkout of his/her assigned SCBA unit at the beginning of each shift (or weekly if a volunteer firefighter) to confirm the SCBA is fully functional (NFPA 1852). Further, any malfunction, before entry or while in the building, must require an immediate exit from the building and perhaps a May Day call.

- *NEVER treat or consider the SCBA as just another tool on the apparatus. It is a critical life support system. The firefighter must ensure it will function properly.*

- *Firefighters must always check their air supply and confirm a full bottle before entering a burning structure. They should also have some knowledge of their individual air consumption rate that will help calculate projected time in the hazard zone.*

- *It's important for the company officer to know crew members consumption rates – the firefighter who consumes more air than the others should be monitored as that firefighter will likely determine when the crew will need to exit the building.*

- *Firefighters must frequently check their air supply while in the structure. Air supply should be checked before and after going up or down stairs. Air supply should be checked before entering and searching a room and after going down a hall way or isle and before and after doing a labor demanding task. The air supply must be checked every minute or so. Firefighters must always know what their air supply is at all times.*

- *SCBA air consumption during laborious firefighting tasks can be more than double the "old" minute rating system for SCBA bottles. (The old" 30 minute" bottle rating can be consumed in 15 minutes or less).*

- *Firefighters should provide frequent air supply status reports to their company officer (or team leader) so that he/she has some awareness of the teams remaining air supply. The company officer should also include the lowest air supply status as part of progress reports to the incident commander or the division or group officer.*

- *Air supply status reports improve the logistical commitment of crews. The incident commander or division/group supervisor will have early awareness of the approaching need for a fresh crew – as compared to getting surprised as the crew announces its exit from a position because they are running out of air. With on-going of air supply status, the incident commander can call fresh crews up from staging and conduct a transition at the operating position instead of at the door after exit.*

- *The National Near Miss Reporting System lists **"Situational Awareness"** as the most commonly reported cause for a life threatening near miss event. The next three most reported causes of near miss events are; decision making, human error, and individual action.*

- ***Situational awareness is defined as**; the level of understanding and attentiveness one has (the firefighter) regarding the reality of a set of conditions (fire conditions and fireground operations). When situational awareness is high, there are rarely surprises. When situational awareness is low or absent, "unexpected" events occur (that can injure or kill firefighters). Simply put, situational awareness is the relationship between what one perceives is happening and what is really happening. **Simply put; firefighters must pay attention to <u>what's really happening, all the time!</u>***

- ***The set of conditions that affects situational awareness can be broken down into three divisions:** a lack of information, a lack of knowledge and a lack of cognition. These three divisions have their own unique factors, including misinterpreting conditions and surroundings, not recognizing factors and cues, gathering of incomplete information, being narrowly focused (tunnel vision) and being impaired.*

- ***Every firefighter should begin to observe or otherwise be aware of their surroundings.** They should note landmarks, windows, exits, and route he and his crew has taken when penetrating the building. These are important landmarks for self survival if the firefighter becomes separated, can't connect with his crew and now is trying to exit the building. These landmarks and location awareness become very critical to firefighter survival when declaring a May Day. The more detailed and accurate the location description or landmarks, the faster a RIT will find you.*

- *Another "simply put" - Firefighters must be aware of their work environment and in control of their actions – **ALL THE TIME!***

- *All firefighters, for basic self survival purposes, must maintain constant awareness of their surroundings. Conditions early on in the fire attack may be out of control, placing the firefighter at continued risk. Even after the fire is controlled, the buildings structural*

integrity has been compromised- sometimes considerably, and the collapse potential can increase.

- *Monitoring fireground communications is another very important area of maintaining situational awareness.*

- *Firefighters must also recognize what is happening elsewhere on the fireground can affect their risk exposure and safety.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents where failure to constantly monitor SCBA air supply or maintain situational awareness about all that was happening at all times which was a contributing factor to fire fighter LODDs including:

Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom – South Carolina;

http://www.cdc.gov/niosh/fire/reports/face200718.html

On June 18, 2007, nine career fire fighters (all males, ages 27 – 56) died when they became disoriented and ran out of air in rapidly deteriorating conditions inside a burning commercial furniture showroom and warehouse facility. **The first arriving engine company found a rapidly growing fire at the enclosed loading dock connecting the showroom to the warehouse.** The Assistant Chief entered the main showroom entrance at the front of the structure but did not find any signs of fire or smoke in the main showroom. He observed fire inside the structure when a door connecting the rear of the right showroom addition to the loading dock was opened. **Within minutes, the fire rapidly spread into and above the main showroom, the right showroom addition, and the warehouse. The burning furniture quickly generated a huge amount of toxic and highly flammable gases along with soot and products of incomplete combustion that added to the fuel load. The fire overwhelmed the interior attack and the interior crews became disoriented when thick black smoke filled the showrooms from ceiling to floor. The interior fire fighters realized they were in trouble and began to radio for assistance as the heat intensified.** One fire fighter activated the emergency button on his radio. The front showroom windows were knocked out and fire fighters, including a crew from a mutual-aid department, were sent inside to search for the missing fire fighters. Soon after, the flammable mixture of combustion by-products ignited, and fire raced through the main showroom. Interior fire fighters were caught in the rapid fire progression and nine fire fighters from the first-responding fire department died. At least nine other fire fighters, including two mutual-aid fire fighters, barely escaped serious injury.

One Career Firefighter/Paramedic Dies and Part-time Firefighter is Injured When Caught in Residential Structure

NIOSH Case number F2010-10

Executive Summary

On March 30, 2010, a 28-year-old male career fire fighter/paramedic (victim) died and a 21-year-old female part-time fire fighter/paramedic was injured when caught in an apparent flashover while operating a hoseline within a residence. Units arrived on scene to find heavy fire conditions at the rear of a house and moderate smoke conditions within the uninvolved areas of the house. A search and rescue crew had made entry into the house to search for a civilian who was entrapped at the rear of the house. The victim, the injured fire fighter/paramedic, and a third fire fighter made entry into the home with a charged 2 ½ inch hoseline. Thick, black rolling smoke banked down to knee level after the hoseline was advanced 12 feet into the kitchen area. While ventilation activities were occurring, the search and rescue crew observed fire rolling across the ceiling within the smoke. They immediately yelled to the hoseline crew to "get out." The search and rescue crew were able to exit the structure safely, then returned to rescue the injured fire fighter/paramedic first and then the victim. The victim was found wrapped in the 2 ½ inch hoseline that had ruptured and without his facepiece on. He was quickly brought out of the structure, received medical care on scene, and was transported to a local hospital where he was pronounced dead.

The firefighter victim was found to have his portable radio tucked in his rear pocket of his station uniform pants and under his bunker pants. It would have been impossible for him to hear radio communications and he could not have declared a May Day.

Career Probationary Fire Fighter and Captain Die as a Result of Rapid Fire Progression in a Wind-Driven Residential Structure Fire – Texas

NIOSH Case number 2009-11

Shortly after midnight on Sunday, April 12, 2009, a 30-year old male career probationary fire fighter and a 50-year old male career captain were killed when they were trapped by rapid fire progression in a wind-driven residential structure fire. The victims were members of the first arriving company and initiated fast attack offensive interior operations through the front entrance. Less than six minutes after arriving on-scene, the victims became disoriented as high winds pushed the rapidly growing fire through the den and living room areas where interior crews were operating. Seven other fire fighters were driven from the structure but the two victims were unable to escape. Rescue operations were immediately initiated but had to be suspended as conditions deteriorated. The victims were located and removed from the structure approximately 40 minutes after they arrived on location.

Key contributing factors identified in this investigation include: an inadequate size-up prior to committing to tactical operations; lack of understanding of fire behavior and fire dynamics; fire in a void space burning in a ventilation controlled regime; high winds; uncoordinated tactical operations, in particular fire control and tactical ventilation; failure to protect the means of egress with a backup hose line; inadequate fireground communications; and failure to react appropriately to deteriorating conditions.

The captain victim dismantled his apparatus without his portable radio. Thus, he was operating blind and without the ability to be aware of radio communications (in deteriorating conditions) and without the ability to provide the incident commander any progress reports. Nor could he have declared a May Day

His partner and victim number 2, a probationary firefighter, was found to have his portable radio in the bunker coat pocket – but, it was turned off and on the wrong channel. He also was operating blind to any radio communications or reports of fire conditions (or evacuation orders).

Two Volunteer Fire Fighters Die When Struck by Exterior Wall Collapse at a Commercial Building Fire Overhaul - Alabama

http://www.cdc.gov/niosh/fire/pdfs/face200607.pdf.

On February 21, 2006, a 62-year-old male volunteer fire captain (Victim # 1) and a 23-year old male volunteer fire fighter (Victim # 2) died when they were struck by a collapsing exterior wall of a one-story commercial building during overhaul operations following a structure fire. The building was approximately 50 years old and had been renovated several times with at least two additions. The exterior walls were constructed of concrete blocks. However, multiple layers of different siding materials covering the front wall of the building hid the underlying concrete block wall from view. The fire was reported at approximately 1728 hours and **fire fighters from a number of fire departments were on-scene for several hours containing the fire to the building.** The heavy timber roof collapsed after burning for over 2 hours. The last mutual aid crew was released before 2100 hours**.** The remaining fire fighters noticed that concrete **block walls** on both sides of the structure were **starting to lean outward** so sections of the walls that were **bulging outward** were pulled down. **At approximately 2130 hours, the two victims, along with a third fire fighter, were stretching a 1 ¾ inch hand line to the front entrance to put water on hotspots when the front wall collapsed, striking the two victims.** The third fire fighter was handling the houseline a few feet behind the two victims and was struck on the foot by falling debris, narrowly missing serious injury.

Career Battalion Chief and Career Master Fire Fighter Die and Twenty-Nine Career Fire Fighters are Injured during a Five Alarm Church Fire – Pennsylvania

http://www.cdc.gov/niosh/fire/pdfs/face200417.pdf

On March 13, 2004, a 55-year-old male career Battalion Chief (Victim #1) and a 51-year-old male career master fire fighter (Victim #2) were fatally injured during a structural collapse at a church fire. Victim #1 was acting as the Incident Safety Officer and Victim #2 **was performing overhaul, extinguishing remaining hot spots inside the church vestibule when the bell tower collapsed on them and numerous other fire fighters.** Twenty-three fire fighters were injured during the collapse were transported to area

hospitals. A back draft occurred earlier in the incident that injured an additional six fire fighters. The collapse victims were extricated from the church vestibule several hours after the collapse. The victims were pronounced dead at the scene.

NEAR MISS REPORTS

Report#06-282

Units noticed smoke in the area while responding to an EMS call. They were then notified of a structure fire and responded. Upon arrival they encountered a ranch-style home with heavy smoke showing from the front door. **Police officers on scene, fire dispatch, and a resident on-scene all told the Captain that a 9 year-old boy was trapped in the basement.**

The crew advanced a 1.75" line to the basement and found heavy smoke conditions with relatively low heat. They searched the basement exhaustively, found a burning mattress but had not located the missing child. In the meantime, other crews were completing a search of the main level. **The Captain's low-air alarm sounded but he decided to continue searching. At about the same time that a relief crew arrived downstairs, the Captain ran out of air. He unsealed his mask and took a total of two breaths at the floor level before he was able to exit the basement. It was later determined that the missing child was at a neighbor's house.**

Report#09-1081

Brackets [] denote reviewer de-identification.
Engine [1] was alerted to a structure fire on [name deleted]. I was riding up as the officer that evening and **upon arrival we found a wood frame residential building with a working fire** on the Alpha/Bravo corner of the structure. I passed on command as a Chief Officer arrived and assumed a fire suppression role. My crew stretched a 1 ¾" attack line to the front door with zero visibility inside the structure and as **I was masking up on the front steps. I laid my gloves just on the inside of the doorway and when I finished masking up, I reached for my gloves and they were gone. I did not know that we had a fully involved basement fire and the fire had already burned out the main floor my crew was preparing to enter.** Engine [1] then took a defensive mode and extinguished the fire from the exterior.

Report#07-697

While commanding a single family residence house fire that started from a lightning strike, **a firefighter depleted his air and got lost in the residence.** The residence was a single story ranch home with brick and had 2 additions in the rear where the fire started. The firefighter was assigned to interior fire attack group with the Assistant Fire Chief and three additional firefighters. The firefighter was removing sheet rock from the ceiling and extinguishing the fire in the attic. **He stated that his low alarm was going off but he did not notify anybody. He continued to work until his air ran out. While trying to leave the residence he got disoriented for a short period before finding the Assistant Chief, who showed him**

the way out. The firefighter was equipped with his own radio and **the SCBA was working properly including the heads-up display.** Upon exiting the residence, the I/C was notified that the firefighter was going to the ambulance for rest and oxygen with a paramedic. After being evaluated and treated, he was transported to the local hospital for smoke inhalation.

Constantly Monitor Fireground Communications for Critical Radio Reports.

Objective: To cause all firefighters and company officers to maintain constant awareness of *all* fireground radio communications on their assigned channel for progress reports, critical messages and other information that may affect their risk and safety.

NO GO. If your team is not equipped with a radio(s) don't enter a burning building.

NO GO. If your team is equipped with only one radio and the radio fails while in the building and you have no other means to communicate - exit.

Narrative

Portable radios are the lifeline for firefighter survival. Both the International Association of Fire fighters and the International Association of Fire Chiefs support the position that EVERY firefighter operating within the hazard zone must be equipped with a portable radio or other approved voice communication device

Portable radios are not only the fire crew's lifeline connection with the incident command and rescuers they also allow the firefighter to increase situational awareness by closely monitoring the assigned tactical channel. Radio communications from other points on the fireground provide additional information about changing fire conditions elsewhere and help the firefighter maintain situational awareness. Conditions will either be improving or deteriorating. Worsening conditions elsewhere on the fireground can quickly result in unsafe conditions in other areas and puts these firefighters at great risk.

Closely monitoring the radio traffic for critical progress reports also provides a greater lead time for fire crews to evacuate the structure should fire conditions rapidly deteriorate. All crew members must monitor radio communications – even if the company officer has the only radio. Sometimes the company officer in charge of the crew may miss critical communications because of noise, etc. and a crew member can alert the officer.

It's also important the company officer or team leader provide supervisors, or the incident commander, frequent progress reports so that the command organization maintains real time situational awareness and can adjust the action plan. These ongoing radio reports also keep other crews informed of progress or deteriorating conditions.

In situations where the crew may have only one radio and that radio fails, while in a burning building, the crew MUST evacuate to a safe location and report their situation. A crew without a working radio is put at great risk because they lose their connection with the incident commander and rescuers. They also lose the ability to be aware of changing conditions that may threaten them or to hear the order to evacuate the building.

NO GO. If your team is not equipped with a radio(s) don't enter a burning building.

NO GO. If your team is equipped with only one radio and it fails while in the building and you have no other means to communicate - exit.

Teaching Points

- *Both the International Association of Fire fighters and the International Association of Fire Chiefs support the position that EVERY firefighter operating within the hazard zone must be equipped with a portable radio or other approved voice communication device.*

- *The firefighter must maintain constant situational awareness of changing conditions in his/her area of work, AND elsewhere on the fireground. Firefighters must closely monitor all radio communications on their assigned radio channel. Worsening conditions elsewhere on the fireground can quickly affect firefighter safety in all other work areas.*

- *The firefighter's radio is also their life line connection with the incident commander and rescuers and helps the firefighter maintain situational awareness of conditions near, and elsewhere on the fireground, that may affect their safety and risk.*

- *All team members must listen to all radio communications. Sometimes the company officer, or lead firefighter in charge of the crew, may miss critical communications for the crew because of noise, etc.*

- *It's also important the company officer or team leader provide supervisors or the incident commander frequent progress reports so that the command organization maintains real time situational awareness from all points on the fireground. These progress reports should also contain a report on the current air supply status of the crew.*

- *In situations where the crew may have only one radio and that radian fails while in a burning building the crew must evacuate to a safe location and report their situation. They same would apply if the crew were equipped with more than one radio and for some reason they all become inoperable. If a crew losses all communication capability they will be unaware of reports of changing conditions that may threaten them and they will be at great risk. In this situation firefighters must exit the building.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which failure to monitor fireground radio communications for progress reports may have been a contributing factor to fire fighter LODDs including:

One Career Firefighter/Paramedic Dies and Part-time Firefighter is Injured When Caught in Residential Structure

NIOSH Case number F2010-10

Executive Summary

On March 30, 2010, a 28-year-old male career fire fighter/paramedic (victim) died and a 21-year-old female part-time fire fighter/paramedic was injured when caught in an apparent flashover while operating a hoseline within a residence. Units arrived on scene to find heavy fire conditions at the rear of a house and moderate smoke conditions within the uninvolved areas of the house. A search and rescue crew had made entry into the house to search for a civilian who was entrapped at the rear of the house. The victim, the injured fire fighter/paramedic, and a third fire fighter made entry into the home with a charged 2 ½ inch hoseline. Thick, black rolling smoke banked down to knee level after the hoseline was advanced 12 feet into the kitchen area. While ventilation activities were occurring, the search and rescue crew observed fire rolling across the ceiling within the smoke. They immediately yelled to the hoseline crew to "get out." The search and rescue crew were able to exit the structure safely, then returned to rescue the injured fire fighter/paramedic first and then the victim. The victim was found wrapped in the 2 ½ inch hoseline that had ruptured and without his facepiece on. He was quickly brought out of the structure, received medical care on scene, and was transported to a local hospital where he was pronounced dead.

The firefighter victim was found to have his portable radio tucked in his rear pocket of his station uniform pants and under his bunker pants. It would have been impossible for him to hear radio communications and he could not have declared a May Day.

Career Probationary Fire Fighter and Captain Die as a Result of Rapid Fire Progression in a Wind-Driven Residential Structure Fire – Texas

NIOSH Case number 2009-11

Shortly after midnight on Sunday, April 12, 2009, a 30-year old male career probationary fire fighter and a 50-year old male career captain were killed when they were trapped by rapid fire progression in a wind-driven residential structure fire. The victims were members of the first arriving company and initiated fast attack offensive interior operations through the front entrance. Less than six minutes after arriving on-scene, the victims became disoriented as high winds pushed the rapidly growing fire through the den and living room areas where interior

crews were operating. Seven other fire fighters were driven from the structure but the two victims were unable to escape. Rescue operations were immediately initiated but had to be suspended as conditions deteriorated. The victims were located and removed from the structure approximately 40 minutes after they arrived on location.

Key contributing factors identified in this investigation include: an inadequate size-up prior to committing to tactical operations; lack of understanding of fire behavior and fire dynamics; fire in a void space burning in a ventilation controlled regime; high winds; uncoordinated tactical operations, in particular fire control and tactical ventilation; failure to protect the means of egress with a backup hose line; inadequate fireground communications; and failure to react appropriately to deteriorating conditions.

The captain victim dismantled his apparatus without his portable radio. Thus, he was operating blind and without the ability to be aware of radio communications (in deteriorating conditions) and without the ability to provide the incident commander any progress reports. Nor could he have declared a May Day

His partner and victim number 2, a probationary firefighter, was found to have his portable radio in the bunker coat pocket – but, it was turned off and on the wrong channel. He also was operating blind to any radio communications or reports of fire conditions (or evacuation orders).

Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom – South Carolina;

http://www.cdc.gov/niosh/fire/reports/face200718.html

On June 18, 2007, nine career fire fighters (all males, ages 27 – 56) died when they became disoriented and ran out of air in rapidly deteriorating conditions inside a burning commercial furniture showroom and warehouse facility. The first arriving engine company found a rapidly growing fire at the enclosed loading dock connecting the showroom to the warehouse. **Within minutes, the fire rapidly spread into and above the main showroom, the right showroom addition, and the warehouse. The burning furniture quickly generated a huge amount of toxic and highly flammable gases along with soot and products of incomplete combustion that added to the fuel load. The fire overwhelmed the interior attack and the interior crews became disoriented when thick black smoke filled the showrooms from ceiling to floor.** The interior fire fighters realized they were in trouble and began to radio for assistance as the heat intensified. One fire fighter activated the emergency button on his radio. Officers working outside the structure initially did not hear the radio Mayday until an off-duty officer responding to the scene in his personal vehicle heard the Mayday and advised the Chief that a Mayday was being called over the radio. The front showroom windows were knocked out and fire fighters, including a crew from a mutual-aid department, were sent inside to search for the missing fire fighters. Soon after, the flammable mixture of combustion by-products ignited, and fire raced through the main showroom. Interior fire fighters were caught in the rapid fire progression and nine fire fighters from the first-responding fire department died. At least nine other fire fighters, including two mutual-aid fire fighters, barely escaped serious injury.

NEAR MISS REPORTS

Report#06-234

Multiple companies operating at a residential fire that started in the walk-out basement. The 1st due Engine arrived and stretched a 2 1/2" through a garage that led directly into the basement area. Other companies stretched 2- 1 3/4" lines into the first floor. I arrived and was assigned by the IC to assist in the basement. After operating for the life of my 30 minute SCBA, I exited to change bottles and observed that conditions had not improved, but deteriorated. As I re-approached the scene, the IC (B/C) pulled everyone out, and an aerial was used to darken down the fire. **While this was being set-up the Company Officers met, and the comment was made by one that the first floor had a hole in it that you could put a car in. This information was never relayed to the IC or other companies operating on-scene**. After using the Aerial, some company officers wanted to re-enter even though additional portions of the interior structure had collapsed.

Report#07-738

My department was dispatched to a possible dwelling fire. Our first engine arrived on scene and advised they had a working fire. The chief of the department arrived on scene and assumed command, reporting about 60% involvement. A crew went interior for fire attack and another crew was sent to the roof. I arrived on scene and was assigned a crew to do a primary search. While doing the primary, I realized that Fire Attack had extinguished most of the fire. I determined that instead of one working fire with 60 % involvement, we actually had 3 separate fires in three separate rooms. I heard the saw cranking up on the roof and realized that ventilation was not needed. **I called out to command to stand by on the roof vent just as I saw a member of the fire attack crew stand up onto a chair and poke his head up into the attic access. He quickly came back down as the saw blade went by his head.**

You Are Required to Report Unsafe Practices or Conditions That Can Harm You. Stop, Evaluate and Decide.

Objective: To prevent company officers and firefighters from engaging in unsafe practices or exposure to unsafe conditions that can harm them and *allowing any member to raise an alert about a safety concern without penalty* and mandating the supervisor address the question to ensure safe operations.

NO GO. If anything will harm you, don't do it! Report it immediately to command or your supervisor.

Narrative

The nature of firefighting nearly always places the company officer and crew members in the area of greatest risk. As such they must remain alert to unsafe conditions or practices that can harm them and have a process for reporting and correcting them. This Rule accomplishes that.

Because of the significant risk to firefighters it is the responsibility of the incident commander (and the command organization) to minimize their exposure to unsafe conditions and stop unsafe practices. NIOSH firefighter fatality reports also routinely describe incidents where unsafe conditions or practices existed which were either not observed or reported and later became a contributing factor in the line of duty death.

The National Near Miss Reporting System lists **"Situational Awareness"** as the most commonly reported cause for a life threatening near miss event. Situational awareness is defined as; the level of understanding and attentiveness one has (*the firefighter*) regarding the reality of a set of conditions (*fire conditions and fireground operations*). When situational awareness is high, there are rarely surprises. When situational awareness is low or absent, "*unexpected*" events occur (*that can injure or kill firefighters)*. Simply put, situational awareness is the relationship between what one perceives is happening and what is really happening. **Pay attention to what's really happening!**

The factors which affect situational awareness can be broken down into three divisions: a lack of information (i.e. knowledge the building contents/layout), lack knowledge (inadequate training) and a lack of cognition (not understanding what's happening). These three divisions are made up of their own unique factors, including misinterpreting conditions and surroundings, not recognizing factors and cues, gathering of incomplete information, being narrow focused and being impaired.

Every firefighter must observe or otherwise be aware of his surroundings, landmarks, windows, exits, and route he takes when penetrating the building. These are important landmarks for self survival if the firefighter becomes separated or lost. These keys items become critical when facing a life threatening emergency and the firefighter's ability to safely exit the building. Additionally, the more detailed and accurate the location description, or landmarks, provided when calling a May Day, the faster a RIT can reach a firefighter.

The fire service has always been a para-military organization when it comes to fireground operations. In most cases, the incident commander makes a decision, sends the order down to through supervisors to the company officer and crew. Fire crews generally view these orders as top down direction. There is often little two-way discussion about options. Where this culture exists, crews have been trained to accept the order and do it – generally without question. This situation makes it very uncomfortable for firefighters to say no to unsafe conditions or practices. Additionally, the fire service has not clearly defined how a firefighter, supervisors, or the incident commander should process a safety concern identified by a firefighter.

The aviation industry experienced a similar problem of one way decision making and communication. The old culture placed the captain in charge of all aircraft operations. The culture didn't tolerate a challenge from crew members. As a result, post crash investigations found captains occasionally flew their planes into the ground, even as other crew members, including the co-pilot, knew something was wrong, and often tried to tell the pilot – only to be rejected.

The commercial airline industry fixed their problem through a new management system called "cockpit crew resource management". This new system required the captain to listen to crew input regarding safety, and authorized the crew to participate in risk assessment and decision making. They became a team looking out for their own welfare as well as their passengers. The program resulted in a rather dramatic reduction in accidents caused by pilot errors.

This Rule applies the principles of crew resource management by encouraging all firefighters to apply situational awareness and be responsible for their own safety and that of other firefighters. In a sense all firefighters become the additional eyes and ears of the incident commander and alerting him (or the immediate supervisor) of unacceptable situations. No fire attack or building is worth the life of a firefighter or a preventable (sometimes career ending) injury. The intent of this Rule is to allow any member to report a safety concern through a structured process without fear of penalty.

This Rule by no means suggests that a firefighter is authorized to engage in insubordination. The fireground is fast paced action and clearly must be managed by a well disciplined and structured command organization. *This policy statement does, however, allow a "red flag" to be raised about a safety issue by any member.* When the red flag is raised, *the supervisor is mandated to accept that concern*, take a few seconds to stop (assess), talk, and make a safe decision (go, no-go). In some cases, the situation may affect other areas of the fireground, or the action plan, and must be communicated to the incident commander or other supervising officers.

Recent research by Underwriters Laboratory's determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

The firefighter must also be aware of the affects of wind on fire development and intensity. Any wind over 10 mph begins to have increasing dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increase risk to any firefighters downwind while in a building. The higher the wind speed the more intense the fire conditions. Once downwind windows fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building firefighters will be subject to a much greater blow torch affect than created by positive pressure ventilation.

Where wind conditions exists firefighters the incident commander may need to alter the old rule of "attacking fire from the unburned side" and attack the fire from the upwind side.

Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.

Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.

Bottom line; It is every firefighters responsibility to prevent harm to one's self and other firefighters. Stop or report unsafe practices and report unsafe conditions.

Teaching Points

NO GO. <u>If anything will harm you, it's a no-go. Report it immediately to command or your supervisor.</u>

- *The firefighter is nearly always to point person working in the area of greatest risk.*
- *No fire attack or building is worth the life (or injury) of a firefighter.*
- *Every firefighter is responsible for their individual safety and the safety of other firefighters. Each firefighter is responsible for identifying risks and hazards and reporting them.*

- *Supervisors are responsible for accepting reports regarding safety concerns without penalizing the firefighter and properly acting on the report to ensure the safety of firefighters.*

- *This item by no means suggests that a firefighter engage in insubordination. The fireground is fast paced action and clearly must be managed by a well disciplined and structured command organization. This policy statement does, however, allow any firefighter to raise a "red flag" safety concern without penalty.*

- *When the situation is questioned, the supervisor is mandated to accept that safety concern, take a few seconds to stop (assess), talk, and make a safe decision (go, no-go, or modify the objective/task).*

- *In some cases, the situation may affect the incident commander's action plan or other areas of the fireground and must be reported to the incident commander or other supervising officers. The policy has proven to be successful in reducing risk to firefighters.*

- *Recent research by Underwriters Laboratory's determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.*

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover,* ***the time from onset of untenability to flashover was less than 10 seconds!*** *This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a downwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

- *Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.*

- *Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which exposure to unsafe practices or conditions were not reported that may have been a contributing factor in LODD's, including:

Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom – South Carolina;

http://www.cdc.gov/niosh/fire/reports/face200718.html

On June 18, 2007, nine career fire fighters (all males, ages 27 – 56) died when they became disoriented and ran out of air in rapidly deteriorating conditions inside a burning commercial furniture showroom and warehouse facility. **The first arriving engine company found a rapidly growing fire at the enclosed loading dock connecting the showroom to the warehouse.** The Assistant Chief entered the main showroom entrance at the front of the structure but did not find any signs of fire or smoke in the main showroom. He observed fire inside the structure when a door connecting the rear of the right showroom addition to the loading dock was opened. **Within minutes, the fire rapidly spread into and above the main showroom, the right showroom addition, and the warehouse. The burning furniture quickly generated a huge amount of toxic and highly flammable gases along with soot and products of incomplete combustion that added to the fuel load. The fire overwhelmed the interior attack and the interior crews became disoriented when thick black smoke filled the showrooms from ceiling to floor. The interior fire fighters realized they were in trouble and began to radio for assistance as the heat intensified.** One fire fighter activated the emergency button on his radio. The front showroom windows were knocked out and fire fighters, including a crew from a mutual-aid department, were sent inside to search for the missing fire fighters. Soon after, the flammable mixture of combustion by-products ignited, and fire raced through the main showroom. Interior fire fighters were caught in the rapid fire progression and nine fire fighters from the first-responding fire department died. At least nine other fire fighters, including two mutual-aid fire fighters, barely escaped serious injury.

Throughout this incident, leading up to flashover, there were numerous observable or described unsafe conditions and practices. Unsafe practices included lack of implementation of the incident command system, using undersized fire attack lines (including a booster line) for fire conditions/magnitude of fire, attacking the fire on the interior with tank water and no hydrant supply, inadequate sized hose (2.5 inch) supply lines, no consistent buddy teams, lack of ventilation, etc.

Unsafe conditions included a continued advancing and expanding fire that fire crews were never able to achieve any kind of fire control.

Residential House Fire Claims the Life of One Career Fire Fighter–Florida

cdc.gov/niosh/fire/reports/face20004.html

On November 25, 2000, a 30-year-old career male fire fighter (the victim) died in a residential house fire. At 0135 hours, fire fighters received a call of a reported structure fire. Engines 5, 2, 1, Ladder 11, and Rescue 32 responded to the early morning call. At 0141 hours, Engine 5 arrived on the scene and the Captain assumed incident command (IC). **The IC reported to dispatch that they had a well-involved, single-story house fire. He then decided to send a search team inside the structure because it was *unclear if the homeowners had exited*.** The victim from Engine 5, and the Captain and the Lieutenant from Rescue 32, teamed up to enter the house and complete the search. The victim, Captain, and Lieutenant advanced a 1¾-inch handline through the front door as the Captain and Lieutenant from Ladder 11 were ordered to set up positive pressure ventilation (PPV) fan at the front door and then back up the search crew. The Lieutenant and a fire fighter from Engine 1 advanced a second line to the rear of the structure to attack the fire. The victim, and the Captain and Lieutenant from Rescue 32, advanced their line down a hallway and into a bedroom when **the Captain noticed heavy fire in a room off to their right.** The Captain requested that the victim pass him the nozzle because there was heavy fire in an adjacent room in the rear of the structure and he was afraid it was going to flash. The Lieutenant responded, saying that they could not locate the nozzle. **In fear of a possible flashover, the Captain ordered the victim and Lieutenant to exit immediately. As the three attempted to exit, the hallway became heavily involved with fire. The Lieutenant and Captain fell over debris and the victim became disoriented. The Captain and Lieutenant exited the structure but the victim did not exit.** The IC immediately ordered exterior crews to enter the structure and search for the missing victim. Approximately 56 minutes later, fire fighters found the victim. He was pronounced dead at the scene.

Career Fire Fighter Dies and Two Career Fire Fighters Injured in a Flashover During a House Fire - Ohio

http://www.cdc.gov/niosh/fire/pdfs/face200312.pdf

On March 21, 2003, a 25-year old male career fire fighter (the victim) was fatally injured in a flashover during a house fire. **The victim and two other fire fighters were on an interior attack crew and had just gone through the front door of a single family residence. The hose line was uncharged and the crew was calling for water when a flashover occurred. From the time the victim arrived on scene until the flashover was approximately four minutes.** After the flashover, fire fighters on the front porch witnessed the victim walk toward the front door then turn and retreat into the structure. The two other fire fighters on the interior crew exited through the front door. They were injured and transported to the hospital where they were treated and released. The victim was located and removed from the structure within 10 minutes. He was transported via ambulance to the hospital where he was pronounced dead.

NEAR MISS REPORTS

Report #09-364

On the morning of [date and time deleted], we received an alarm of a structure fire about ½ mile from Station [1]. Engine [1], Engine [2] and Rescue [1] responded.

Upon the arrival of Engine [1] and Rescue [1] we found heavy smoke showing from the structure. Engine [1] laid two 1 ¾" lines and caught the hydrant right across the street. Engine [1] group went in

through the front door, but due to extreme amount of heat, were not able to get to the seat of the fire. Group 1 lieutenant called for vertical ventilation but due to staffing issues, ventilation was not able to be performed.

Our chief arrived on scene and assumed command. He advised us to exit the building and we were going defensive. After exiting the house, group 1 pulled their line to the C-side of the structure and Group 2 (off of Engine [2]) pulled the second 1 ¾" to the B-side of the structure. The Incident Commander then advised the first arriving off duty personnel to set up the PPV fan at the front door. Once two off-duty personnel arrived, they became Group 3 and set up and turned on the fan. The structure was an old [deleted] house built in the early 1900s with a very big and open attic. After the smoke cleared, the Incident Commander advised Group1 and 2 to stop flowing water because Group 3 was going in the front door and we were going back offensive.

Due to heavy fire, Group 3 was doing no good and backed out. Two more off-duty personnel arrived and the Incident Commander made them Group 4 and assigned them to vertically ventilate. **This order was given 45 minutes into the fire and approximately 30 minutes after a defensive attack was ordered and the PPV fan was set up. The roof was already visibly sagging and from the road you could see heavy fire in the attic. Three lieutenants and a captain on scene advised the Incident Commander that the task was unsafe. Group 4 ignored our plea and put a ladder on the building.** Once on the roof and starting to ventilate, the roof gave way and collapsed. The two firefighters in Group 4 were standing on the roof ladder and were able to roll off the house. The roof ladder sustained major fire damage and the firefighter making the cuts was very lucky that his back up firefighter was holding onto him and saw the roof start to give way. This allowed for the backup firefighter to pull the [power saw operator] up and fall off the rood onto the ground instead of into the fire.

After it was over, the firefighters from Group 4 stated that the Incident Commander ordered us to ventilate and we were not going to break an order."

Report#08-470

During a training fire, **we were training probationary firefighters on stages of fire and fire attack. The lieutenant conducting interior operations let the fire continue to grow without knocking it down. He had probies standing up in the heat, which was unsafe**. The fire then grew to a point that we needed to evacuate the structure. Firefighters were slow to exit the building. Because of poor communications after exiting the building, probies attempted to re-enter an unsafe environment to extinguish the fire. They were in the training house just inside the door when they did back out. Poor communications, leadership, and decision making contributed to this near-miss. The fire could have flashed over.

Report#09-1006

At approximately 0900, firefighters were dispatched to a report of a commercial structure fire with smoke showing. **Additional reports stated there was a possibility of someone trapped inside. Upon arrival of fire personnel, the battalion chief gave an initial size up of a wood frame, brick office building with heavy smoke showing.** While fire crews were preparing to make an attack on the fire and perform a search and rescue operation, the battalion chief was attempting to perform a walk-around of

the structure. He was passing the “B” side of the structure and approaching the “C” side when he realized there was a basement area. The basement area had a window that had been broken with heavy smoke coming from the window. **When he approached the window (for whatever reason), he decided to look into the basement. He did this by sticking his head into the window area. This is when a huge cloud of smoke engulfed him.** The battalion chief was not wearing any PPE and was only dressed in the station uniform. He immediately retreated to safety and was not injured, but did inhale a good bit of smoke.

Case Report - Seattle Fire Department

On the night of January 5, 1995, four Seattle firefighters died when the first floor of a commercial warehouse collapsed.

In 2001 a Seattle ladder company officer and a probationary firefighter became lost on the third floor of an apartment building during a multiple alarm fire. As they were trying to find their way out, the officer ran out of air and became separated from the firefighter. The firefighter was able to find and exit. The officer, now sucking smoke, found a window a dropped three stories and received severe injuries but survived.

In July, 2001, a new fire chief was appointed. Within two months, two additional near fatal incidents occurred. One firefighter became separated from his partner in the hold of a multiple ship fire and ran out of air. By chance, another crew found the firefighter and the crew exited with the firefighter.

A month later, a captain at a working residential fire experienced a mechanical failure on his SCBA and collapsed from smoke inhalation. Another crew found the unconscious fire officer and rescued him. He was incubated and transported to the hospital where he fully recovered.

The fire chief called a “Safety Stand Down” and had staff rapidly develop a Firefighter Survival Training Program. The fourth quarter scheduled training was dropped and replaced with the survival training. Included was multi-bullet a new “Best Safety Practices” policy. One of the bullets stated;

- Any Member is Authorized to Say NO to Unsafe Practices or Conditions. Stop, Talk, and Decide.

During training, a survivor of the 1995 fire described arriving as a second due engine company with heavy smoke issuing from the building. His crew stretched a hoseline to the front door to back up the first crew that had entered earlier. As he was putting on his face piece he noted smoke pushing out of cracks in the sidewalk and thought that was awfully odd. The culture at the time (like many fire departments) made it awkward for any firefighter to challenge a company officer on a decision. The crew entered the building and moments later the floor fell away from them.

He told the training officer that had the new policy with the above bullet been in place that night in 1995 he would have been far more comfortable to raise an alert and perhaps all the firefighters would have been saved.

You Are Required to Abandon Your Position and Retreat Before Deteriorating Conditions Can Harm You.

Objective: To cause firefighters and company officers to be aware of fire conditions and cause an early exit to a safe area when they are exposed to deteriorating conditions, unacceptable risk and a life threatening situation.

Narrative

Our occupation puts firefighters in a constantly changing hazardous environment. Firefighters are frequently exposed to deteriorating conditions and occasionally are caught in flashovers or other conditions that injure or kill firefighters. Our cultural sometimes creates a situation where firefighters feel they need to stand their ground where fire is about to overtake them and therefore may not have time to safely exit.

Firefighters are nearly always at a point of greatest risk when operating on the fireground and, as such, will often detect a rapidly deteriorating condition before the incident commander. Flashovers can develop in seconds and firefighters may only have a few more seconds of survival time when they do occur. Where the situation creates a high potential for an injury, or a life threatening situation, no firefighter needs approval from a supervisor or the Incident Commander to abandon a high risk position. Nor, should they be required to report their intent to abandon if reporting impedes or delays a rapid exit to a safe location.

Recent research by Underwriters Laboratories determined that a fire in a modern home (contents of plastics and synthetics) can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

Firefighters should never push the safety envelop and extend risk for what is already lost or cannot be controlled.

The incident commander should also be aware of the affects of wind on fire development and intensity. Any wind over 10 mph begins to have increasing dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increase risk to any firefighters downwind while in a building. The higher the wind speed the more intense the fire conditions. Once downwind windows fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building that hallway the firefighters are in will be subject to a much greater blow torch affect than created by positive pressure ventilation.

Withdrawal from a life threatening position must occur early enough to allow a safe exit from the building or to relocate to a safe location. Firefighters should understand that an emergency exit from a building often takes longer than it took to get into the interior operating position and conditions will be worse. No hesitation should occur as seconds can mean surviving or dying. If saving the hoseline or any equipment will delay exit – the firefighter should leave it behind and get out. It's far better for the crew to abandon the position early rather than try to take a needless stand and be pushed out.

Where wind conditions exists firefighters the incident commander may need to alter the old rule of "attacking fire from the unburned side" and attack the fire from the upwind side.

A radio report to the Incident commander (or the Division/Group Supervisor) on the decision to abandon the position should be made as soon as possible, but only when safe to do so and where it does not cause a delay in exiting.

The culture of firefighters "standing their ground" with a willingness of taking on overwhelming flame of heat where the fire cannot controlled with existing fire attack lines cannot be tolerated. Evidence of firefighters who engage in this risky behavior is illustrated by repeated events resulting in melted or heat damaged helmets or damage to other personal protective equipment. These firefighters often also have a repeated burn injury history. Where this behavior exists, the fire department management team must intervene and eliminate this unsafe behavior and culture.

This Rule by no means suggests that firefighters, or the incident commander, abandon a firefight where progress in fire control is being achieved. Interior firefighting is tough business. Where crews are advancing and knocking down fire as they proceed, the action plan may be working. Where crews are not advancing, and especially where fire is pushing back, or about to overtake a crew, is when firefighters should retreat to a safe location and before they are harmed. When faced with this situation the company officer and firefighters must be comfortable with the knowledge they have the authority to abandon a position they can't hold.

Bottom line; if the firefighters wait until the fire overwhelms them before retreating, it may be too late

Teaching Points

> **NO GO.** If the fire is about to overtake you, retreat to a safe location or exit the building before you are harmed.

NO GO. <u>If you radio lose communications, exit the building.</u>

- *Firefighters are nearly always at a point of greatest risk when operating on the fireground.*

- *No fire attack or building is worth the life or injury of a firefighter.*

- *No firefighter needs approval from a supervisor, or the Incident Commander, to abandon a high risk operation that deteriorates and becomes unsafe and life threatening if doing so (reporting) impedes or delays a rapid exit to a safe location. Firefighters should withdrawal and retreat to a safe location and notify the Incident Commander of the action as soon as it's safe to do so.*

- *Withdrawal from a position must occur early enough to allow a safe exit from the building or to relocate to a safe location.* ***Firefighters should NEVER push the safety envelop and extend risk for what is already lost, or cannot be controlled and about to be lost.***

- *Recent research by Underwriters Laboratories determined that a fire in a modern home (contents of plastics and synthetics)* ***can create a flashover in just 3 minutes and 40 seconds!*** *This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.*

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover,* ***the time from onset of untenability to flashover was less than 10 seconds!*** *This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a downwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

- *Conditions can deteriorate rapidly and often creating life threatening conditions for the firefighter. Under these conditions the proper firefighter decision is to immediately abandon the position and exit the building or seek a safe location. No hesitation should occur as seconds can mean surviving or dying. Seconds can make the difference.* ***Firefighters should NEVER "stand your ground"*** *with deteriorating fire conditions that cannot be controlled.*

- *Emergency exit from a building will be more difficult and often takes longer than it took to penetrate the interior operating position and conditions will be worse. It's far better to abandon the position early rather than try to take a needless stand and be pushed out.*

- *A radio report to the Incident commander (or the division/group supervisor) on the decision to abandon the position should be made as soon as possible, but only when safe to do so and when it does not cause a delay in exiting.*

- *Firefighters should not allow equipment to delay the exit when fire is overtaking them. If tools or hoseline will delay exit – leave them. The same applies for any other equipment.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in failure to be constantly aware of changing fire conditions and failure to exit to a safe location in a timely fashion were contributing factors to fire fighter LODDs, including:

Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom – South Carolina;

http://www.cdc.gov/niosh/fire/reports/face200718.html

On June 18, 2007, nine career fire fighters (all males, ages 27 – 56) died when they became disoriented and ran out of air in rapidly deteriorating conditions inside a burning commercial furniture showroom and warehouse facility. The first arriving engine company found a rapidly growing fire at the enclosed loading dock connecting the showroom to the warehouse. The Assistant Chief entered the main showroom entrance at the front of the structure but did not find any signs of fire or smoke in the main showroom. He observed fire inside the structure when a door connecting the rear of the right showroom addition to the loading dock was opened. **Within minutes, the fire rapidly spread into and above the main showroom, the right showroom addition, and the warehouse. The burning furniture quickly generated a huge amount of toxic and highly flammable gases along with soot and products of incomplete combustion that added to the fuel load. The fire overwhelmed the interior attack and the interior crews became disoriented when thick black smoke filled the showrooms from ceiling to floor. The interior fire fighters realized they were in trouble and began to radio for assistance as the heat intensified.** One fire fighter activated the emergency button on his radio. The front showroom windows were knocked out and fire fighters, including a crew from a mutual-aid department, were sent inside to search for the missing fire fighters. Soon after, the flammable mixture of combustion by-products ignited, and fire raced through the main showroom. Interior fire fighters were caught in the rapid fire progression and nine fire fighters from the first-responding fire department died. At least nine other fire fighters, including two mutual-aid fire fighters, barely escaped serious injury.

Partial Roof Collapse in Commercial Structure Fire Claims the Lives of Two Career Fire Fighters – Tennessee.

http://www.cdc.gov/niosh/fire/reports/face200318.html

On June 15, 2003, a 39-year-old male career Lieutenant (Victim #1) and a 39-year-old male career fire fighter (Victim #2) **died while trying to exit a commercial structure** following a partial collapse of the roof which was supported by lightweight metal trusses (bar joists). The victims were part of the initial entry crew searching for the fire and possible entrapment of the store manager. **Both victims were in the back of the store operating a handline on the fire that was rolling overhead above a suspended ceiling. A truck company was pulling ceiling tiles searching for fire extension when a possible backdraft explosion occurred in the void space above the ceiling tiles.** Victim #1 called for everyone to back out due to the intense heat, just as the roof system at the rear of the structure began to fail, sending debris down on top of the fire fighters. Victim #1 and Victim #2 became separated from the other fire fighters and were unable to escape. Crews were able to remove Victim #2 within minutes and transported him to a local hospital where he succumbed to his injuries the following day. Soon after Victim #2 was removed, the rear of the building collapsed preventing further rescue efforts until the fire was brought under control. Victim #1 was recovered approximately 1 ½ hours later.

Noonday, TX,-A Volunteer Mutual Aid Captain and Fire Fighter Die in a Remodeled Residential Structure Fire – Texas;

http://www.cdc.gov/niosh/fire/pdfs/face200729.pdf

On August 3, 2007, a 19 year-old male fire fighter (victim #1) and a 42 year-old male Captain (victim #2) responding from the same volunteer mutual aid department were fatally injured during a residential structure fire. While enroute, **the fire district's Assistant Chief requested mutual aid from two neighboring departments due to dispatch updating the report to a fully involved structure fire.** At 0150 hours, the Assistant Chief (Incident Commander) arrived on scene with four other fire fighters in an engine. At 0151 hours, **the first interior attack crew entered the structure with flames visible in the foyer.** At 0213 hours, the initial attack crew briefed a new interior attack crew (the victims) from the second mutual aid department on the location of a few hot spots to be knocked down. At 0216 hours, the IC requested ventilation. **Horizontal and vertical ventilation was conducted and a powered positive pressure ventilation fan was utilized at the front door but little smoke was pushed out. Minutes later, heavy dark smoke pushed out of the front door. The IC made several attempts to radio the interior attack crew with no response.** Approximately 21 minutes after entry, an evacuation horn was sounded. A three member RIT team made entry and located one of the victims, but was unable to fully extricate him. Ultimately, several RIT teams were necessary to recover the victims. Both victims died of smoke inhalation and thermal injuries.

NEAR MISS REPORTS

Report #05-589

Dispatched to a reported chimney fire at (address deleted) while enroute to the fire in (company deleted) advised by units on scene that it would be a working house fire. As the officer on the truck I collected my crew accountability tags and placed them on the ring.

Next, I donned my pack, grabbed the TIC, and attached it to my pack. I told FF (name deleted) to help catch the hydrant. When we arrived, the hydrant was in the yard across the street from the fire.

There was heavy fire coming from the B, C side; we pulled a 2 ½ to the C side and knocked down the majority of the visible fire. We decided an interior attack would be performed. The Lt, and Chief, and myself pulled a cross lay to the front door. I then put on my mask and pulled up my nomex. The front door was locked so I broke the window next to it and reached through an unlocked the door. When we opened the door, heavy black smoke came out. The smoke was down to the floor and there was no visibility on the first floor. As we searched for the stairs to the second floor we went down a step and then across the kitchen floor and back up the step and found the step leading to the upstairs. As we went up the stairs, I yelled back to the Chief to stop and feed us more hose because the stair way had a turn in it.

When we got to the top of the stairs, you could feel that it was getting hotter and we went to the right. There was still no visibility at this time. As we went down the hall trying to find a door we heard the Chief yelling that if we couldn't find it then we need to start backing out. At this time, I felt a door handle and yelled that I had found one. I stood up on my knees to open the door and at that time, **I could see fire come from behind me. The fire completely covered my body. I fell to the floor and started rolling around trying to get the fire out when I felt like I had it out I felt my body to make sure I wasn't still on fire.**

I looked around and could not see anyone. I called a mayday. I started searching for another room or a window because the hallway I was in was on fire, the stairs were on fire, and I needed a way out. However, I didn't find anything at this time. The fire in the hall died down and I felt for the hoseline. When I found it, I started to follow it to the stairs. I found the Lt and told him to get out and he dove down the stairs that were still on fire.

I then heard someone yelling and I went back down the hallway to try to find him. However, I didn't find anything. I turned around and went back to the stairs, which were still on fire. At this time I started to wonder if we we're going to make it out of this predicament.

I stooped and waited at the top of the stairs trying to see if the fire would die down when it didn't I made the decision that I wasn't going to just sit here and wait to die. I dove head first through the fire down the stairs. And I hit the wall where the stairs made a turn and started rolling down them when I got to the bottom I could see the Lt who yelled at me and we found the front door and ran to it when we got there it had shut and we were beating and pulling on it trying to get it open after doing this for a while I calmed down and realized that the door had locked after we went in. I unlocked it, opened it and we went out and went down in the front yard.

They stripped us of our gear. My helmet was damaged, my coat was damaged. Both parts of the gear were damaged due to the high heat conditions.

Report #07-860

My department [Department name deleted] responded to a mutual aid call for a large multi-unit apartment fire. This incident was commanded by a neighboring fire department [Department name deleted]. The incident was located in a mixed use area of [City name deleted]. Upon arriving on scene (5-10 minutes after first arriving units) the four man crew from [Name of company deleted] was instructed

by the Incident Commander to make entry and advance a hoseline into one of the upstairs burning units. They were instructed to begin attacking the fire in the common attic shared by multiple upstairs apartment units. They took a scuttle hole ladder, pike poles, axes, and a charged hoseline with them and entered the smoke filled unit. Two of us began breaching the ceiling sheetrock with a pike pole and positioned a scuttle hole ladder to access the attic space overhead. The other two personnel had the charged hoseline and worked their way to a large source of smoke coming from a shared wall between the units we were in and the adjacent unit. The hose team used a second pike pole to open the wall between the units. **They found a large volume of fire in the adjacent unit. As the two on the hose team backed up to inform us of the situation, the floor began sagging and cavernously opening up where the floor met the wall adjacent to the burning unit. This revealed a large volume of fire in the downstairs unit directly below us.** The officer of our hose team pulled the nozzleman back from the opening in the floor and our interior crew immediately backed out of the apartment. After everyone was safely outside, our team reported the rapidly deteriorating fire conditions to the Incident Commander. We then descended the exterior metal stairs to ground level and pulled our equipment back. As we were performing this task, the Incident Commander gave the order for immediate withdrawal of all interior crews and sounded three blasts on all the air horns. Approximately two minutes after the evacuation was ordered, the building we were working in collapsed.

This incident had the potential for a significant loss of life if the interior crews continued working and were not made aware of the rapidly deteriorating conditions. It is my opinion that the Incident Commander could have more fully sized up the extent of the fire. An assessment should have been made regarding the degree in which the ground floor units were involved before ordering teams to make entry into the overhead upstairs units. Despite being "packed up", our somewhat limited visibility, our diminished situational awareness created by our SCBA masks, and our [Manufacturer deleted] hoods, **we should have checked the fire conditions downstairs before proceeding upstairs.**

Report#08-384

Engines [2], [1] and Truck [1] were dispatched to a reported residential structure fire with reported entrapment. While enroute units were advised that the police department was on scene with confirmed entrapment. The shift officer then requested that an additional engine be assigned to the box. Engine [3] was immediately dispatched. Knowing that Engine [1] and Truck [1] would arrive shortly after Engine [2] **the shift officer ordered Engine [2] to proceed straight in and attempt a rescue.** He then ordered Engine [1] to lay in and Truck [1] to advance a 1 3/4" line to protect the search crew. Engine [2]'s crew complied with the order and made entry via the 1st floor front door. Despite encountering high heat and heavy smoke conditions, they made entry to search for the trapped victims. They advanced up the stairs to the second floor through fire in the stairwell. **The crew, faced with deteriorating conditions on the second floor, continued the search. They quickly found two children obviously deceased and correctly decided to leave the victims and continue the search. Conditions began to become untenable as they returned to the hallway.** During these first few moments, the crew from Truck [1] advanced a dry line to the front door. The structure had a front porch with a roof. The crew from Truck [1] stopped on the porch and completed donning of their SCBA and PPE. They called for the line to be charged once they were completely equipped. **For reasons not determined, the line was not immediately charged but neither firefighter was willing to leave the line to return to the engine to get it charged.** During this time, the fire flashed over as the crew from Engine [2] proceeded down the second floor hall to the windows that they had observed prior to entering the structure.

As Engine [2] bailed out of the front window they were followed by fire, causing damage to their PPE that required one set to be retired from service. The crew from Truck [1] continued to wait for water on the porch while heavy fire vented out of the front door. They remained in place even though their PPE received significant thermal damage. Water was eventually supplied to the line and Truck [1] advanced into the structure making good progress. The incident went to a 2nd alarm and resulted in the death of three civilians.

Report#10-010

It was after lunch and our station was alerted for a reported house fire. The dispatch report was fire in a second floor bathroom. The area is not serviced by a municipal water supply so tankers were added at the time of dispatch. I was the officer on the truck company and arrived behind a chief officer, who was on scene about one minute prior to our arrival. **His report advised a larger single-family home with the occupant outside and nothing evident.** The truck was able to position in the driveway on the Alpha /Delta corner. We met briefly with the homeowner who advised us she thought the fire was on the 2nd floor in a bathroom. My tiller man and I entered the structure from the side Delta entrance. There was a light haze of smoke. When we entered the living room area, I made a transmission over the radio that the house was full of "junk" and for all units to use caution. **The homeowner was a hoarder and there was no visible floor. Magazines and papers and boxes were all over the place.**

As we proceeded to find the fire, there was still no IDLH; however, the smoke was a little thicker in the living room but only about one foot from the ceiling. I heard command start placing units in service from our assignment to run another fire in a bordering company's area. I made a transmission that we definitely had a fire in this house and we haven't found it yet so don't release anybody.

My tiller man and I did a complete primary of the house and found increasing smoke conditions but no fire. It was obvious to us the fire was on the first floor. We closed windows and watched were the smoke was coming from. In the living room, the smoke increased so we focused our attention there. I have to add there were two hose lines in place at this time, one at the main entrance and another one at the side Delta entrance.

Neither hose line was advanced into the house because we didn't know where the fire was and, due to the hoarding, the thought was once you went in and got in place you were stuck. There was no room to move around or re-position a hose line.

I was standing in the middle of the living room and using the thermal imager started to scan the area. I saw an area of high heat on the Charlie/ Bravo corner of the living room. I directed my tiller man to the area and he opened up. The area was a door and when he struck it with his pike pole, the room was free-burning. We attempted to shut the door but the fire escaped so fast we were unable to shut it. The room went from some visibility to zero visibility and high heat. We as a team recognized immediately we were in a bad situation and scrambled to exit. We were able to make it back to our initial entry point. I made a transmission to the crews at the front door were the fire was.

We were met by another crew in the kitchen. The fire was coming through the door right behind us. We were able to shut that door enough to keep the fire from entering the kitchen area. We then exited the kitchen onto the porch on the Delta side and made it to the exterior.

Declare a May Day As Soon As You THINK You Are In Danger.

Objective: To ensure the firefighter is comfortable with, and there is no delay in, declaring a May Day when a firefighter is faced with a life threatening situation and the May Day is declared as soon as they THINK they are in trouble.

Narrative

Our occupation places the firefighters in constantly changing hazardous environments. Even where the best safety practices are applied, the unexpected can happen. Firefighters can be exposed to unexpected rapidly deteriorating conditions that can quickly become life threatening. Or the firefighter may become separated from fellow crew members and lost in the building. **Any delay in declaring a May Day can become lead to a lethal event**.

The lack of recognition of the need for an early May Day declaration – and the need for this Rule is illustrated by a survey conducted by Dr. Burt Clark of the National Fire Academy. When asked if the firefighter would declare a May Day if faced with "zero visibility, no contact with hoseline or lifeline, do not know direction to an exit" only 82 per cent would declare a May Day. Only 58 percent would declare a May Day if they could not find an exit in 60 seconds. Both these situations mandate an immediate May Day declaration! (See appendix B for more information regarding May Day's and RIT operations).

There is a very narrow window of survivability when a firefighter gets in trouble with a life threatening situation. Any delay in declaring a May-Day eats into the survival time window. The firefighter must NEVER hesitate to declare a May Day! Firefighters should also provide the incident commander their name, company, location, air supply and situation along with any other critical information that will aid rescuers in quickly locating them.

When declaring a May Day, the firefighter should also activate the radio's emergency alert button (where provided) and then manually activate the PASS device. New technology also allows the radio to be programmed to go to a designated emergency channel, clear of the tactical radio traffic, to declare the May Day. This allows the firefighter to talk DIRECTLY to the incident commander free of interference.

The term "May Day" has been endorsed by the two largest fire service organizations in the country as the term to be used for a firefighter experiencing a life threatening emergency. The IAFC Board of Directors endorsed the term May Day in 2007 as the standard term to be used when a firefighter is in trouble and designating term "emergency traffic" to be should be used to alert firefighters to other fireground emergencies. The IAFC's Safety, Health and Survival Section strongly encourager's all fire departments adopt the term May Day.

The IAFF also has been recommending May Day to identify a firefighter in trouble for more than a decade. The term "May Day" is used throughout its newly developed "Fire Ground Survival" training program (highly recommended). Further, a national survey conducted by Firehouse magazine (2008) with 10,327 responses has determined overwhelmingly that firefighters currently use, or prefer the use,

of the term “May Day”. The term “emergency traffic” only garnered a 5% vote. It’s important that fire departments adopt May Day and develop training programs emphasizing early declaration.

Both organizations believe that the term “May Day” should be reserved only for a situation where a firefighter is experiencing a life threatening emergency. The term “emergency traffic” should be utilized for other emergencies on the fireground (i.e. evacuate the building, live power lines down, etc.).

It’s important that fire departments adopt the term May Day as the emergency term to be used by firefighters experiencing a life threatening situation and include the term in all standard operating procedures/guidelines. Fire departments should also train in May Day procedures and RIT operations. Training must emphasize the immediate declaration of a May Day when the firefighter is facing a life threatening situation. If the emergency is resolved before the RIT reaches the firefighter in trouble, the RIT can be cancelled (and some real life RIT training experience was obtained).

There is a common links in firefighters delaying to declare a May Day and military pilots delaying to eject from a crippled aircraft. According to Richard Leland, Director Aeromedical Training Institute Environmental Tectonics Corp., there are 10 reasons for failure or delayed ejection that must be address in ejection training:

1. Temporal Distortion (time seems to speed up or slow down).

2. Reluctance to relinquish control of one’s situation.

3. Channeled attention (continuing with a previous selected course of action because other more significant information is not perceived).

4. Loss of situational awareness (controlled flight into terrain).

5. Fear of the unknown (reluctance to leave the security of the cockpit)

6. Fear of retribution (loss of the aircraft)

7. Lack of procedural knowledge

8. Attempting to fix the problem.

9. Pride (ego)

10. Denial (this isn't happening to me.)

These 10 reasons should help fire department instructors, and individual firefighters, understand why a firefighter may fail, or delay, calling a May Day. All training protocols and fire department must emphasize the need for an immediately call of a May Day.

The firefighter must also understand that rapid intervention may not be rapid and any delay in declaring a May Day also puts rescuers at greater risk. Research conducted by the Phoenix and the Seattle fire departments determined that it would take between 19 and 21 minutes to search, locate, and remove a firefighter from a building. This rescue time can easily exceed the air supply remaining in the victims and rescuers SCBA.

The research exercises were conducted in buildings involving 5,000 square foot buildings. While rescue time will vary depending on square footage, and complexity of the building, the lesson is if a firefighter gets in trouble, RIT is not going to be rapid! Research also determined that an average of 11- 12 firefighters was needed to search, find, and the extract a downed firefighter. It should also be noted that 20 per cent of the rescuers got disoriented or lost during these exercises and would have faced a life threatening situation in an actual fire.

Firefighters should also understand that this research was conducted under "sterile" non-fire conditions. One can expect actual rescue times to be even longer under actual fire conditions, which would involve zero visibility, high heat, smoke, wet and slippery floor conditions with debris littering the floor.

Bottom line; Firefighters should NEVER, ever hesitate to declare a May Day.

Teaching Points

NO GO. If you're lost, separated or in trouble do not try to find your way out by yourself. Declare a May Day

- *Both the IAFC and the IAFF strongly endorse the use the term "May Day" to declare an emergency. The IAFF also uses the term "May Day" (as the IAFC has done in the Rules of Engagement) throughout its newly developed "Fire Ground Survival" training program. Fire departments must adopt the term "May Day" as the emergency term to be used by a firefighter experiencing a life threatening emergency – and reserved only for that circumstance. The term "emergency traffic" should be used for other fireground emergencies (i.e. evacuate the building, live power lines down, etc.).*

- *Even with the best safety practices, unexpected events can occur on the fireground. Firefighters can become lost or trapped in the building. When this happens, there is a very narrow window of survivability exits. Immediate action must take place.*

- *There is a very narrow window of survivability when a firefighter finds him/herself in trouble. Any delay in declaring a May-Day eats into the survival time window.*

- *If the firefighter is about to run out of air, or already out of air, he/she faces a very toxic atmosphere that will quickly incapacitate them, followed shortly by death. Declare a May-Day before you run out of air.*

- *NEVER hesitate! As soon as you THINK you're in trouble – declare the May-Day!*

- *Firefighters should provide the incident commander their name, company, location, air supply and situation or other critical information that will allow rescuers to quickly locate you.*

- *When declaring a May Day, also activate the radio's emergency alert button and then manually activate the PASS device. (Some fire service professionals recommend activating the emergency button first, and then declare the May Day). Additionally, new technology allows the radio to be programmed be immediately transfer to a designated emergency channel, clear of the tactical radio traffic, to declare the May Day and talk DIRECTLY to the incident commander (free of interference).The newer technology can automatically identify firefighters by name and company assigned.*

- *Also, firefighters must understand that rapid intervention* ***may not be rapid.***

- *Research conducted by the Phoenix and the Seattle fire departments determined that it would take between 19 and 21 minutes to search, locate, and extract a firefighter from a building. This time exceeds the average air supply time of most SCBA bottles.*

- *The research was conducted in buildings involving 5,000 square foot buildings. While Rescue time will vary depending on square footage, and complexity of the building's interior. The research does illustrate if a firefighter gets in trouble, RIT is not going to be rapid! Research also determined an average of11- 12 firefighters were needed to rescue a downed firefighter.*

- *Also, understand that this research was conducted in "sterile" exercises under non-fire conditions. One can expect actual rescue times to be even longer under actual fire conditions, which involve zero visibility, high heat, and water, wet and slippery floors with debris littering the floor.*

- *If a firefighter becomes separated and cannot get re-connected with his partner immediately he must get on the radio and attempt to communicate with his company officer or partner. If re-connection is not accomplished with three radio attempts or re-connection is not established within one minute a May Day should be declared.*

- *The firefighter must next activate the radio's emergency alert button followed by manually turn on the PASS alarm. (NOTE; some departments may require the emergency button to be activated before declaring a May Day).*

- *Do not delay a May Day declaration if fire conditions are deteriorating –a one minute delay with deteriorating conditions can be life threatening. If the firefighters get reconnected before a RIT arrives, the May Day can be cancelled.*

- *The term "May Day" is now widely accepted by the American fire service. The International Association of Fire Chiefs has officially endorsed the term of May Day to be used by the firefighter experiencing a life threatening emergency. The IAFC's Safety, Health and Survival Section strongly encourages all fire departments adopt the term. It is recommended that the term "emergency traffic" be use for other emergency notification such as ordering the building evacuated or the power lines are down, etc. Both terms comply with NFPA standards.*

- *In 2009 Firehouse magazine asked readers what term they used when a firefighter found himself in trouble. Of the 10,327 responses, 7332 (70%) voted for "May Day, May Day, May Day!" Only 5 percent believed emergency traffic was an appropriate term for a firefighter in trouble.*

NOTE: The International Association of Fire Fighters (IAFF) has developed a multi-day firefighter survival training program titled "Fire Ground Survival". This is an excellent course in preventing and surviving life threatening May Day emergencies and is highly recommended. To obtain more information, contact the IAFF headquarters at 202-737-8484.

SPECIAL NOTE: See Appendix B for additional support information regarding May Day emergencies.

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which the lack of an early May Day declaration (or no May Day) and fireground survival training was a contributing factor to fire fighter LODDs including:

Career Fire Fighter Dies and Captain is Injured During a Civilian Rescue Attempt at a Residential Structure Fire – Georgia

http://www.cdc.gov/niosh/fire/reports/face200716.html

On May 28, 2007, a 41-year-old male career fire fighter (the victim) died after becoming disoriented and falling down a set of stairs while searching for a missing male occupant at a residential structure fire. A fire captain also received second degree burns resulting in lost-time from work. Both the victim and the captain were members of the first-responding fast attack engine company. **After becoming disoriented, they were trapped and missing for several minutes before being found.** The fire was reported at approximately 0449 hours. The first arriving fire fighters, including the victim, arrived on the scene at 0459 hours and were on-scene 13 minutes when the first mayday was called. The male resident also perished in the fire.

Career Fire Fighter Dies of Carbon Monoxide Poisoning after Becoming Lost While Searching for the Seat of a Fire in Warehouse - New York

http://www.cdc.gov/niosh/fire/pdfs/face200404.pdf

On December 16, 2003, a 30-year-old male fire fighter (the victim) died after he became separated from his crew members while searching for the seat of a fire at a furniture warehouse. His crew exited due to worsening conditions and a missing member announcement was made. At one point while inside the warehouse, members of an engine crew thought they heard a scream but could not identify the source. After an evacuation order was given and as engine crew members were exiting, **the victim's officer mistakenly identified one of them as the missing member and cancelled the emergency message**. Once fire fighters had exited, a personnel accountability report (PAR) was taken on the street which revealed that the victim was still missing. The victim's officer initiated a second emergency message for a missing member and a search was begun. The victim, who had a working radio, was found lying face down with his face piece removed and 900 psi left in his self-contained breathing apparatus (SCBA). His Personal Alert Safety System (PASS) alarm was reported by fire fighters to be inaudible. His carboxyhemoglobin (COHb) level was 74.8% in the emergency room. **The victim did not declare a May Day and did not activate his radios emergency alert button.**

Career Fire Fighter Dies After Becoming Trapped by Fire in Apartment Building – NJ

On May 9, 2001, a 40-year-old male career
firefighter (the victim) died after he became trapped in a third-floor apartment while searching above the fire for occupants. The victim and Fire Fighter #1, from Truck 2, were assigned to

conduct a primary search for a mother and her children who were reported as being trapped in a second-floor apartment. The victim and Fire Fighter #1 conducted a primary search of three of the four apartments on the second floor while two Lieutenants (from Engine 2 and Engine 3) and a Captain (from Truck 2) were attacking the fire with a 1¾-inch handline in the fourth apartment. No civilians were found on the second floor. The victim and Fire Fighter #1 proceeded up the stairwell toward the third floor where they encountered heavy smoke and high heat. The victim and Fire Fighter #1 then descended the stairwell to the second-floor landing. Fire Fighter #1 told the victim to stay on the hoseline and to help the Lieutenants while he went to get some box lights from the truck. Fire Fighter #1 had just returned to the second floor landing when the Lieutenant from Engine 3 informed him that the victim had called over the radio that he was trapped in a third-floor rear apartment. The Lieutenant from Engine 3 had attempted to stretch the handline up the stairwell to the third floor but found that the line was too short to reach down the hall toward the rear apartments. The fire fighter assist and search team (FAST) made several attempts to locate the victim but were unsuccessful due to the fire spread and deteriorating conditions of the building. The victim was found in an apartment bedroom on the third floor. He was unresponsive and not breathing. Two paramedics responded to the third floor, assessed the victim's condition, and found no heart activity while using a heart monitor. The victim was pronounced dead at the scene.

NEAR MISS REPORTS

Report#08-577

Crews were fighting a fire in a 4 unit rowhouse/townhouse, wood-frame dwelling. Fire was visible from the C side (exterior). Crews reported fire in walls and ceilings on first floor and fire was moving up to the second floor. Initial crews were containing the fire, while an additional crew moved to the second floor for reconnaissance and search. When the reconnaissance crew reached the second floor, 2 members (a lieutenant and a firefighter) entered a bathroom that was located directly above the fire. Almost immediately upon entering the bathroom, a 6' to 7' section of the bathroom floor collapsed with the lieutenant falling through the floor. The lieutenant was able to catch himself on a floor joists and nearby debris. As the floor collapsed, the firefighter jumped into a tub and did not fall through the floor.

Immediately upon falling through the floor, the lieutenant called a "mayday" and provided a clear and concise report detailing his unit, his location, the situation, and his immediate needs. Operations acknowledged the mayday, quickly confirmed the situation, and deployed the RIT team to the location of the trapped lieutenant. Simultaneously, command called for an additional alarm to stage nearby. Upon hearing the mayday and receiving associated information, a firefighter operating in the exterior of the structure notified two additional firefighters that the lieutenant had been seen operating in the area of a second floor window. A ground ladder was raised to the window and several firefighters helped the lieutenant extricate himself from the collapsed floor.

Within a minute or two from the time of the mayday call the lieutenant had been extricated and self-evacuated from the structure. Immediately upon hearing that the trapped lieutenant had been located, extricated, and removed from the building, command removed all personnel from the structure and ordered a PAR. The PAR revealed that all members were accounted for and firefighting operations

commenced. Soon after the incident, the fire was knocked down and placed “under control.” Meanwhile, the lieutenant and firefighter involved in the collapse were examined by an ambulance crew at the scene and no injuries were observed.

Report#09-990

Our department was dispatched to a structure fire reported by police who were initially dispatched to a burglar alarm. First companies arrived to find a two story, wood frame multi-use structure with moderate smoke issuing from the structure. After forcing entry, the engine company (three person hose team) entered with an inch and three-quarter attack line and a TIC. The crew reported high heat conditions and indicated that the TIC screen was red! They proceeded to the right and pushed to the rear of the structure with heavy black smoke but no visible fire. A rescue company (2 person team) entered shortly after the engine company. They too reported extreme heat at the floor and a Red screen on the TIC. The rescue crew also proceeded to the right and pushed to the rear.

Outside, the IC and ladder company crew observed smoke conditions rapidly changing from laminar light brown smoke to a turbulent black smoke pushing from the entry doorway. At this time, IC attempted to contact the initial engine company without success.

Back inside, the rescue crew reached the engine company at the rear wall. They all reported the same high heat conditions with no visible fire. **Some confusion occurred when personnel mingled together and at some point, the rescue crew lost contact with each other. The engine captain also lost track of one of his two rookie firefighters. One of the rescue members retreated outside and reported he had lost his partner. At the same time, the engine captain attempted to radio IC that he too had lost a member of his crew and to report the condition encountered inside.**

Back outside, the IC ordered the ladder company to "vent" a large window on the A Side of the structure. As this window was vented, the ladder crew observed fire at the floor level and it rolled across the room toward the rear of the structure.

The captain of the engine observed the fire roll over head and ordered his crew to evacuate. He reported extreme heat and made a hasty exit out of a window. Upon exiting, he reported that he had lost his crew and a MAYDAY was called. Almost immediately, all interior crews were accounted for at the entry doorway. The engine captain sustained 2nd degree burns to his face. No other injuries were reported. Crews quickly regrouped.

Later arriving companies were assigned to the fire attack, and the fire was quickly contained.

Report#09-1033

At 1730 hrs, our department was dispatched to a reported structure fire (smoke in a structure). Initial response was three engines, one tower, and chief officer. On arrival the first due engine advised of a single story residential (wood frame construction) with no hazards showing (smoke or fire). Command was established, a 1.75" line deployed, and an investigative mode initiated. While searching the interior of the structure, two firefighters encountered, as they described, a light haze of smoke with low heat inside the structure. Upon entering the kitchen area, the members reported brown tan laminar smoke in

the kitchen with low heat conditions. Upon seeing the smoke, both firefighters stopped and donned their SCBA. Finding no fire, the two (lieutenant and firefighter) continued to search for the origin of the smoke. Prior to entering a bedroom off a narrow hallway (29" wide by 10' long), the firefighters decided to leave the hoseline in the hallway outside of the bedroom door.

Seconds after entering the bedroom, a fire erupted in size and intensity that I have never seen before. Given this, the lieutenant declared a working fire and they would be attacking the fire with the charged hoseline. Additionally, the lieutenant called for exterior ventilation of the bedrooms windows. **Within seconds of this transmission, a mayday was declared. The room and exterior went from nothing showing, and I mean nothing showing, to fully involved within seconds. The mayday was called because the firefighters were trapped inside the bedroom.** After venting, the flames engulfed the entire window and seconds later both firefighters dove out of the room through the flames to the exterior. Initially, it was believed that one more firefighter was still inside the structure. However, this turned out to be unfounded.

The preliminary investigation revealed that that one of the firefighters, while in the room and after the flash over, inadvertently closed the bedroom door thinking that they were opening it. Engulfed in fire, they were unable to locate the door and egress to safety, thus they had to run and dive through the flames. As a result, three firefighters were transported to the hospital (two from the interior and one involved in the rescue effort). Through heavenly blessing, none of the three was seriously hurt and all have since been released.

SECTION SEVEN

Explanations and Lesson Plans

The Incident Commanders Rules of Engagement

for Firefighter Safety

Introduction

The Incident Commanders Rules of Engagement for Firefighter Safety assumes that the Incident Command Systems is implemented fully and properly at emergency incidents. This includes building an effective command organization using division and group supervisors. Not to do so create chaos and places all firefighters at high risk for injury or death and violate NFPA standards.

Further, without an effective command organization, the incident commander cannot complete an adequate size up and risk assessment nor can he maintain a high level of situational awareness necessary to keep all firefighters safe.

Essential to effective command operations is a stationary command post. Conducting command operations out of a chief officer's vehicle, or specialized command vehicle, greatly enhances the command function. These vehicles allow for more reliable and more powerful radio communications. Listening (vital to firefighter safety) is also improved because of a quieter interior of vehicles and the use of headsets. These vehicles also allow better night-time lighting for the incident commander (and command staff) along with greater access to tactical plans and other vital information (i.e. hard copy/3 ringer binders or computer files)

Because National Fire Protection Standards require a safety officer to be assigned at working fires, the Rules assume this requirement is also practiced. The Incident Safety Officer must be involved in the continuous risk assessment activity and action plan development as well as ongoing revision of the plan. He must have the authority to cease, or alter operations (and immediately advising the incident commander) to improve fireground operations safer. Any orders to cease or alter a particular activity that may affect the action plan must be reported to the incident commander.

Overview of Explanation of Lesson Plans

The following section provides explanation and lesson plan information reflecting the intent and justification of The Incident Commanders Rules of Engagement for Firefighter Safety.

In the documents which follow, each of the "bullet" statements of the Rules of Engagement has an objective statement, followed by a narrative explanting the intent of the bullet rule and how it is intended to be applied on the fireground. Also included is a list of teaching points. Each Rule "bullet" statement and "objective" also has at least one National Institute for Occupational Safety and Health (NIOSH) Fire Fighter Fatality Investigation and Prevention Program report assigned to it to further illustrate the purpose of each individual bullet statement. Each report is a summary of the full investigation. A report number is provided that will allow the instructor to obtain more information if desired to expand instruction capability.

Also included with each bullet statement are reports from the National Near Miss Reporting System with a case number that provide additional supporting case histories for each bullet statement.

The document also has three selected NIOSH fatality investigations as in-depth case histories.

The Incident Commanders Rules of Engagement for Firefighter Safety

Rapidly Conduct, or Obtain, a 360 Degree Situational Size Up of the Incident.

Objective: To cause the incident commander to obtain an early 360 degree survey and risk assessment of the fireground in order to determine the safest approach to tactical operations as part the risk assessment and action plan development *and before firefighters are placed at substantial risk.*

> **NO GO.** If an assigned objective cannot be achieved because existing conditions prevent success. Stop and evaluate the situation and revise the objective.

Narrative

There has been much discussion in recent years about the need for the incident commander to conduct or obtain a 360 degree size-up of the incident. According to NIOSH firefighter fatality reports repeatedly cite lack of a complete size-up as a leading contributing factor in firefighter deaths.

It's imperative that the incident commander conduct a rapid, yet deliberate 360 degree evaluation of all fireground factors present. The incident commander must develop a logical picture of the fire situation and forecast what's like to happen and what resources will be needed to stabilize the situation.

To keep firefighters safe, the complete fireground must be rapidly assessed by the incident commander before an appropriate and safe action plan can be developed. This requires a quick walk around of all sides of the building by the first arriving company officer (the initial incident commander), OR, the later arriving chief officer incident commander must rapidly obtain radio reports from officers stationed on all sides of the fireground.

Each side of the fireground has its own unique fire conditions and risk that must be assessed. There will be factors that are both visually present and those that are not observable from the command post. The incident commander must know what is burning, where it is, and where it's likely to go. Evaluating these factors will allow the incident commander to forecast future conditions and risk and develop a safe action plan.

There are also a number of critical factors that must be assessed in developing an action plan and they include; building size, arrangement and access, fire location and extension, wind speed and direction, ventilation profile, savable lives and property, resources, adequate firefighter staffing and water supply. All seven sides of the structure must be evaluated; four sides, interior, top and bottom. Evaluating these factors will allow the incident commander to better forecast future conditions.

There are several approaches to obtaining a complete size up. In the rural environment, it may be many minutes before a second due company arrives on the scene providing a reasonable time period for the company officer/incident commander to rapidly conduct a 360 degree size up walk around. Until other

companies arrive, there are no other companies to command. Additionally, where the initial arriving crew is three members the OSHA two-in, two out rule prohibits entry until another crew or officer arrives.

In the urban/suburban environment, four member crews will allow two members to stretch an attack line while the company officer completes a 360 degree size up walk around. Where barriers prevent this, multiple companies will be arriving on scene in a relative rapid sequence and it may be more effective to assign fire crews, or other officers, to various locations on all four sides of the building and obtaining a size up report via radio from company officers.

In some cases, the first arriving chief officer assuming command can drive around the incident building, or conduct his own walk around, in order to obtain a complete 360 degree size up of the fireground. During this brief period a "mobile" command option can be applied while directing companies for a short period of time. Typically, only a few fire companies are on the scene doing this short period and the incident commander function would not be compromised. Where the chief has an aid, utilizing this member for size up duties can be very effective. Once the rapid size up is completed it's absolutely essential that the incident commander establish a stationary command post, preferably in a fire department vehicle. Later arriving chief officers should be assigned appropriate division or group assignments to improve the 360 degree size-up for the incident commander and provide ongoing progress reports.

One cannot under estimate the value to the incident commander of the "visual" aspect of observation all four sides of the incident to effective command decisions. Without it, the incident commander will be limited in vital information. Until the complete 360 degree size up is completed, the incident commander must be cautious in the commitment of fire crews, must constantly monitor changing conditions, and be prepared to immediately adjust crew commitments or withdrawal crews all together.

The incident commander must also understand the size-up is an on-going process requiring frequent progress reports from all points of the fireground. Even with a 360 degree walk around, the situation will be constantly changing and on-going information on conditions from division and group supervisors will be needed to keep the action plan current and safe.

Recent research by Underwriters Laboratories determined that a fire in a modern home **can create a flashover in just 3 minutes and 40 seconds!** This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

The incident commander must understand the affects of wind on fire development and occupant survival. Any wind over 10 mph begins to have increasingly dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increasing risk to any firefighters downwind

while in a building. The higher the wind speed the more intense the fire conditions. Once upwind windows fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building firefighters will be subject to a much greater blow torch affect than created by positive pressure ventilation.

Where wind conditions exists firefighters the incident commander may need to alter the old rule of "attacking fire from the unburned side" and attack the fire from the upwind side.

Lightweight causes increased risk to firefighters because of early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.

Abandoned and dilapidated buildings are a special consideration for a 360 degree size up and decision making. Where an active and progressing fire is present, and the fire is not rapidly knocked down, a defensive strategy should be seriously considered from the outset.

Teaching Points

- *NIOSH investigation of firefighter fatalities has regularly identified lack of a complete 360 degree fireground assessment as a frequently cited contributing factor in firefighter deaths.*

- *To keep firefighters safe, the complete fireground must be rapidly assessed before an appropriate and safe action plan can be developed. This requires a quick walk around of all sides of the building by the first arriving company officer (the initial incident commander), OR, the later arriving chief officer incident commander must rapidly obtain radio reports from officers stationed on all sides of the fireground.*

- *Without a 360 degree rapid assessment, the incident commander is routinely limited to a view of only one or two sides of the fireground. Conditions are often much worse out of sight of the incident commander, thus placing the fire attack crew(s) at risk. Until a 360 degree size- up is obtained the incident commander will always be at a disadvantage about the building access to the interior, the buildings contents, fire conditions and risk factors.*

- *It's imperative that the incident commander conduct a rapid, yet deliberate 360 degree evaluation of all fireground factors present.*

- *Each side of the fireground has its own unique fire conditions and risk that must be assessed. There will be factors that are both visually present and those that are not observable. The incident commander must know what is burning, where it is, and where it's likely to go. Evaluating these factors will allow the incident commander to forecast future conditions and risk.*

- *There are also a number of critical factors that must be assessed in developing an action plan and they include; building size, arrangement and access, fire location and extension, ventilation profile, savable lives and property, resources, adequate firefighter staffing and water supply.*

- *All seven sides of the structure must be evaluated; four sides, interior, top and bottom. Evaluating these factors will allow the incident commander to forecast future conditions.*

- *The incident commander must develop a logical picture of the fire situation and forecast what's likely to happen and what resources will be needed to stabilize the situation.*

- *If significant risks are identified or other important information is observed that will affect firefighter safety or the action plan and tactics must be adjusted by the incident commander to make the fireground safe.*

- *If the size up looks unsafe, "feels" unsafe, DON'T DO IT! Consider other options. Sometimes the "gut" is a good indicator for a no-go decision.*

- *The company officer and firefighter, by the nature of their work, are the persons at greatest risk during offensive firefighting operations. They are also the people "on location" who can best see, or sense, what's happening on their side of the fireground and what the risk may be. The incident commander should listen to what they have to say as part of the initial and on-going size up.*

- *Obtaining a 360 degree size up is about time versus risk. It will take some element of time for the incident commander to obtain a complete 360 size up. During that time period the incident commander should be cautious about assignments for any crews to high risk objectives.*

- *The initial arriving officer may have enough time to rapidly conduct a 360 degree size up before additional crews arrive on scene while an attack crew is stretching a hoseline to the building and while complying with the OSHA " two in - two out" rule.*

- *In the rural environment, it may be many minutes before a second due company arrives on the scene providing a reasonable time period to conduct a 360 degree size up. Until other companies are on scene, there are no other companies to command.*

- *In the urban/suburban environment, multiple companies will be arriving on scene in a relative rapid cessation and it may be more effective to quickly assign fire crews, or other officers, to various locations on all four sides of the building and obtaining a size up report from these officers.*

- *In some cases, the first arriving chief officer assuming command can drive around the incident building (i.e. shopping center), or conduct a quick walk around, to obtain a complete 360 degree assessment of the fireground while assuming command and directing companies for a short period of time. Where a "drive around' is not possible, the initial chief officer assuming command may be able to do a walk about 360 size up (or his aid). Later arriving chief officers may even more time to conduct or obtain a 360 degree size-up for the incident commander.*

- *If barriers prevent a walk around, or drive around, of the fireground, or delay fire crew access to various locations, the incident commander should next assign a fire officer to conduct the 360 degree size up.*

- *The size up also includes evaluation of interior conditions and forecasting where the fire may progress and how quickly.*

- *Until the complete 360 degree assessment is completed, the incident commander must be cautious in the commitment of fire crews, must constantly monitor changing conditions, and be prepared to immediately adjust crew commitments or withdrawal crews all together.*

- *The size-up is an on-going process requiring frequent progress reports from all points of the fireground throughout the incident. Until this size up process is completed the incident commander will have a very limit "picture" of what's happening and the action plan will likely be weak and unsafe without this on-going process.*

- *Resources selected to support fire operations must match the objectives assigned to crews – proper sized and number of hose lines, staffing, etc. or the use of apparatus large caliber monitors. All hand lines must be charged before entering a <u>burning compartment.</u>*

- *Recent research by Underwriters Laboratories determined that a fire in a modern home **can create a flashover in just 3 minutes and 40 seconds!** This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.*

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a upwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

- *Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.*

- *Abandoned and dilapidated buildings are a special consideration for a no-go decision. Where an active and progressing fire is present, and the fire is not rapidly knocked down, a defensive strategy should be seriously considered from the outset.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which a complete 360 degree size-up was not conducted that may have contributed to fire fighter fatalities including:

Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom – South Carolina;

http://www.cdc.gov/niosh/fire/reports/face200718.html

On June 18, 2007, nine career fire fighters (all males, ages 27 – 56) died when they became disoriented and ran out of air in rapidly deteriorating conditions inside a burning commercial furniture showroom and warehouse facility. **The first arriving engine company found a rapidly growing fire at the enclosed loading dock connecting the showroom to the warehouse.** The Assistant Chief entered the main showroom entrance at the front of the structure but did not find any signs of fire or smoke in the main showroom. He observed fire inside the structure when a door connecting the rear of the right showroom addition to the loading dock was opened. **Within minutes, the fire rapidly spread into and above the main showroom, the right showroom addition, and the warehouse. The burning furniture**

quickly generated a huge amount of toxic and highly flammable gases along with soot and products of incomplete combustion that added to the fuel load. The fire overwhelmed the interior attack and the interior crews became disoriented when thick black smoke filled the showrooms from ceiling to floor. The interior fire fighters realized they were in trouble and began to radio for assistance as the heat intensified. One fire fighter activated the emergency button on his radio. The front showroom windows were knocked out and fire fighters, including a crew from a mutual-aid department, were sent inside to search for the missing fire fighters. Soon after, the flammable mixture of combustion by-products ignited, and fire raced through the main showroom. **Interior fire fighters were caught in the rapid fire progression and nine fire fighters from the first-responding fire department died**. At least nine other fire fighters, including two mutual-aid fire fighters, barely escaped serious injury.

Structure Fire Claims the Lives of Three Career Fire Fighters and Three Children – Iowa

http://www.cdc.gov/niosh/fire/pdfs/face200004.pdf

On December 22, 1999, a 49-year-old Shift Commander (Victim #1) and two Engine Operators, 39 and 29 years of age respectively (Victim #2 and Victim #3), lost their lives while performing search-and-rescue operations at a residential structure fire. At approximately 0824 hours, Central Dispatch was notified of a structure fire with three children possibly trapped inside. At approximately 0825 hours, a Shift Commander and an Engine Operator (Victim #1 and Victim #2) were dispatched to the scene. At 0827 hours, Engine 3 (Lieutenant and Victim #3) responded to the scene. **Aerial Truck 2 approaching the scene, reporting via radio that white to dark brown smoke was showing from the residence, and requested six additional fire fighters. When Aerial Truck 2 arrived on the scene at 0830 hours, 2 witnessed a woman and child trapped on the porch roof, and they were informed that three children were trapped inside the house.** Victim #1 proceeded into the house to perform a search-and-rescue operation. Engine 3 arrived on the scene shortly after, and the Lieutenant connected a supply line to the hydrant as Victim #3 pulled the Engine into position. The Lieutenant and Victim #3 stretched a 5-inch supply line and connected it to Aerial Truck 2. At approximately 0831 hours, the Chief and Fire Fighter #1 arrived on the scene, and the Chief assumed Incident Command (IC). At this time, one of the victims removed the first of the three children from the structure, handed the child to a police reserve officer near the front entrance of the structure, and returned to the structure to continue search and-rescue operations. At this time one of the victims removed a second child. The IC grabbed the child and began cardiopulmonary resuscitation (CPR). **Due to limited personnel on the fireground, the IC directed a police officer on the scene to transport him and the child to the hospital.** After donning her gear, Fire Fighter #1 approached the front door and noticed that the 1½-inch hoseline (previously stretched) had been burned through and water was free-flowing. It is believed that the three victims were hit with a thermal blast of heat before the hoseline burned through. The three victims failed to exit as 12 additional fire fighters arrived on the scene began fire suppression and search-and-rescue operations. Victim #2 was located, removed, and transported to a nearby hospital, where he was pronounced dead. Victim #1 and Victim #3 were later found and pronounced dead on the scene.

NOTE: All three children were pronounce dead at the hospital

Volunteer Fire Chief Killed when Buried by Brick Parapet Wall Collapse – Texas

http://www.cdc.gov/niosh/fire/reports/face200821.html

On July 05, 2008, a 42-year old male volunteer fire chief was killed when he was struck by a collapsing brick parapet wall during a commercial structure fire. The fire chief, along with four fire fighters, were finishing mopping up suppression activities at a grass fire when the fire department was dispatched to a structure fire. The fire chief and 2 fire fighters left the scene of the grass fire in a tanker and traveled to the scene of the structure fire where **the fire chief began to size-up the burning commercial structure while the other 2 fire fighters traveled 5 blocks back to the station to obtain an engine and structural fire fighting gear**. The 2 fire fighters returned to the structure fire scene with an engine parked in the street directly in front of the burning automotive repair and upholstery business. **The fire chief grabbed a self-contained breathing apparatus (SCBA) from the engine and pulled a preconnected 1 ¾-inch handline to the front door**, assisted by a fire fighter who had just arrived in her personal automobile. The fire chief worked the nozzle through the doorway (using tank water) while the other fire fighters established water supply. **Less than 5 minutes after the engine arrived on scene and shortly after water supply was established, the brick parapet wall at the front of the structure collapsed, striking the fire chief and burying him under the brick debris**. Rescuers quickly uncovered the fire chief and medical treatment was started immediately. The fire chief, still conscious, was transported to a trauma hospital where he died several hours later.

Nine Fire Fighters from a Combination Department Injured in an Explosion at a Restaurant Fire – Colorado

http://www.cdc.gov/niosh/fire/reports/face200803.html

On February 22, 2008, a deputy chief and eight fire fighters were injured during an explosion at a restaurant fire in Colorado. At 1340 hours, **dispatch reported visible smoke and flames through the roof of a commercial structure.** At 1344 hours, police arrived and began evacuating the restaurant and the adjoining retail store. The restaurant was part of a block-long row of adjoining structures. **Over the next 25 minutes, 3 engines, 2 ladder trucks, and 24 fire department members arrived on scene including the injured fire fighters**. A crew entered the restaurant with moderate smoke showing toward the rear and no flames visible. The crew backed out and entered the retail store (an adjacent building attached to the restaurant) to check for fire in the ceiling but found only light smoke visible. Another crew attempted to ventilate the retail store with a chainsaw, and when the roof was noticed to be spongy, they moved to the roof of the next building, two buildings down from the restaurant. **Interior crews operating in all three buildings had backed out. A crew closed the front doors of the restaurant fearing the oxygen would feed the increasingly greenish-black smoke pushing out of the roof of the restaurant. Fireground personnel noticed the front windows of the restaurant and adjoining retail store were vibrating as flames from the roof of the restaurant intensified. At 1427 hours, the restaurant and two adjoining buildings exploded sending glass, bricks, and wood debris into the street.** The crew on the roof located two buildings down from the restaurant, felt the front portion of the flat roof heave up about five feet, sending a fire officer to the ground below and temporarily trapping four other fire fighters; all incurred injuries. In addition, four fire fighters, positioned on the ground within 6 feet of the store fronts, were injured by flying debris.

NEAR MISS REPORTS

Report#09-532

The fire was in a two story, older commercial structure. The first floor housed a thrift store and an art gallery, with storage on the second floor. The fire started in the rear of the thrift store. **We found heavy fire coming out of the A, D, and C side doors and windows.** Crews went interior with a 2 1/2" line, entering on the D side, and operated about five minutes. Smoke caused the power lines to arc. The hose line was abandoned and the personnel were reassigned.
We were assigned to pull a 2 ½" line to the second floor from the outside stairs. The stairs were loose at the landing. **We attempted to force the door when the door frame fell into the building. The second floor flashed and the roof collapsed. The incident commander changed to a defensive operation and abandoned the building**. Approximately fifteen minutes later the fire breached into the art gallery. One firefighter sustained a minor injury
.

Report#07-908

All hands were working at a 4 alarm fire, involving three, balloon framed, three story, 30'x75' tenement houses. **Heavy structural damage was sustained by the center (origin) structure.** Exposure "B" experienced exterior fire damage as well as a fully involved attic space. The "D" exposure received exterior fire damage. A crew of three firefighters was operating an exterior handline between the original structure and the "B" exposure. At this time **the major body of fire had been controlled, leaving several stubborn pockets of fire to deal with.** The Incident Safety Officer (ISO) noted the crew's position and evaluated the safety of the operation against the risk involved. The center building had been severely weakened by the fire and it was determined that the benefit did not merit the risk. **The ISO ordered the crew to move the line to the adjacent yard at the rear of the building.** This would place them safely out of the collapse zone. **Approximately five to ten minutes later the structure suffered a sudden, catastrophic collapse, sending most of the debris to the area where the crew had been operating before the move. This could easily have resulted in death for our members. Instead it was a non-event.**

Report#09-1146

While returning from a previous incident, the engine spotted light smoke in a residential area. At approximately the same time that they began to report the smoke, the county dispatch rang out a structure assignment to that area. As a result the engine arrived several minutes prior to the next due unit. The structure was a triplex with each unit being approximately 2,500 sq. ft. or 7,500 sq. ft in total. It was built into the side of a grade and entry from the front door placed you on the second floor, leaving you with one floor below and one floor above.

The captain gave a report on conditions that included smoke and fire coming from the roof and all occupants out of the building. The captain then made the decision to don SCBAs, pull an attack line, and make entry through the front door. **A 360 degree survey had not been completed, nor was any other unit on scene.** Upon making entry, the captain reported encountering light smoke at the ceiling level with clear visibility into the structure. He then made the decision to advance the line down a hallway where the captain and fire fighter encountered heavy smoke down to the floor; a second alarm was requested.

At this point, the captain requested ventilation, but no other units were on scene and the department's only truck company has an extended response time into the involved area. The captain and fire fighter

continued to advance until they encountered active fire. After a quick knock down, they employed the use of a thermal imager and spotted an additional heat source to their right, down another hallway. They advanced to that position and began fighting fire in the kitchen area.

The second due engine arrived a full 5 minutes and 11 seconds after the initial unit went on scene. The driver of the first arriving engine had already established his own water supply. The second unit was assigned to back up the first due engine. **After making an initial knock down of the fire in the kitchen, the captain realized he had fire below him and that there was an additional level to the building.** However, he was not aware of how to access the lower level. The captain and fire fighter then began to fight the fire from above it.

It was at this point that the captain and fire fighter suffered burns. It is believed that as the crew was fighting the fire windows on the lower level blew out, creating horizontal ventilation contributing to the rapid acceleration of the fire. The crew, being positioned above the fire, resulted in them being exposed to an excessive amount of heat. This resulted in the captain and fire fighter backing out of the building.

The crew was treated at the hospital. The captain returned to duty and completed his shift. The fire fighter did not return that day. Both the captain and fire fighter were wearing all personal protective equipment including hoods. The fire eventually grew to five alarms.

Determine the Occupant Survival Profile.

Objective: To cause the incident commander to consider fire conditions in relation to possible occupant survival of a *rescue event* before committing firefighters to high risk search and rescue operations as part of the initial and ongoing *risk assessment* and action plan development.

NO GO: If the occupants cannot survive the search AND rescue event do not commit the crews to search and rescue. Obtain fire control before searching.

Narrative

One essential component in the size-up process is to determine if any occupants are trapped and can they survive the current and projected fire conditions and the time it will take to search, find, and extract an occupant/victim.

Our goal as firefighters is to save lives. The fire service has a long history of aggressive search and rescue operations as an initial priority of first arriving fire companies. History (and firefighter fatalities) also reflects that firefighters are exposed to the greatest risk of injury and death during primary search and rescue operations. Search efforts must be based on the potential to save lives. A safe and appropriate action plan cannot be accurately developed until we first determine if any occupants are trapped and can survive the fire conditions during the entire *rescue event* (find AND then remove them). If survival is not possible for the entire extraction period, a more cautious approach to fire operations must be taken. Fire control should be obtained before proceeding with the primary and secondary search efforts.

Fire in a building today is not what it was 50 years ago in the days of our forefathers. Today's building contents contain a large array of plastic products. When exposed to fire, plastics burn hotter and produce highly toxic gases. For example, a pound of wood, when burned, produces 8,000 British thermal units (Buts'). On the other hand, a pound of plastic can produce 19,900 Btu's when burned. That's nearly three times hotter!

As a result of plastics in our buildings, today's fires are hotter, and flashover occurs quicker than in the past. The human limit for temperature tenability is 212 degrees. Fire models for today's environment reflect that flashover can occur in less than five minutes and reach a temperature of more than 1,100 degrees. On many occasions flashover can occur as the first fire companies are arriving on the scene. In such cases the survivability of any victims in that compartment can be very limited or non-existent.

Recent research by Underwriters Laboratories determined that a fire in a modern home **can create a flashover in just 3 minutes and 40 seconds!** This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

The affects of carbon monoxide poisoning on a victim is well known to the fire service. With our plastics environment, carbon monoxide is produced in very high concentrations and very quickly. As a result, victims die sooner than the past.

What is not as well known, but is an evolving killer for both the victim and firefighters is cyanide poisoning. Where carbon monoxide kills by blocking oxygen absorption in the blood, cyanide kills the body's organs. Literature reflects that a low concentration of 135 ppm of cyanide and carbon monoxide will kill a person in 30 minutes. At 3,400 ppm it can kill in less than one minute. It is not uncommon for a fire in today's buildings to routinely produce 3,400 ppm of cyanide. Where a victim may be resuscitated

from the affects of carbon monoxide poisoning, the victim may not survive the organ damage caused by cyanide poisoning. [3]

This research clearly shows occupants die quicker today than in the past – yet the fire service continues to employ aggressive search and rescue tactics of years past. And firefighter fatality reports reflect what can happen without a thorough size-up that includes a survivability profile.

An example of the need to apply survivability profiling as part of action plan development for search and rescue operations is found in a 2005 study by the Boston Globe newspaper. The paper examined firefighter fatality reports related to 52 fires that killed 80 firefighters between 1997 and 2004. In only 14 of those 52 incidents was there even a suspicion of trapped occupants. In only 6 of those 52 incidents were people in the building at the time of the fire departments arrival and not one of those 52 fires resulted in a civilian fatality. [4]

What this research suggests is firefighters are dying at fires where there are NO OCCUPANT/VICTIMS in the building.

The incident commander must factor growing fire conditions, resources on scene (the number of firefighters to complete a rescue), and the time needed to complete a rescue into the decision to conduct and support primary search and rescue operations.

The ultimate question to be considered in regard to survival profiling: If a firefighter cannot survive in the toxic environment without SCBA, and the PPE cannot withstand prolonged exposure above 500 degrees, what makes us think an occupant can survive similar conditions?

Search and rescue and the related removal of any trapped victims from the fire building takes time and quiet often these operations are occurring while conditions continue to deteriorate – sometimes rapidly. This situation decreases the possibility of victim survivability while increasing risk to firefighters. A search and rescue decision must be balanced against time and conditions. In some cases, primary search and rescue operations must be delayed or abandoned because of deteriorating conditions until the fire is controlled.

The incident commander must determine if victims can survive fire conditions individual compartments as part of this evaluation. If there is no potential for survival, the action plan should be based on that determination. For example, a fire in a home in the middle of the night, with fire showing out a rear window, and modest smoke throughout the rest of the building, may allow victim survival in non involved “compartments”.

A fire in the same home in the middle of the night, with significant fire showing from windows of several rooms along with dense smoke, under pressure, pushing out nearly all openings may not allow any

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victims to survive the heat, toxic environment, and the time required to search and remove them. Additionally, a well involved structure will not allow for survival of any victims.

A fire in an apartment building may not allow survival in a well involved apartment (compartment), but the survival profile may be good in the adjacent apartment(s). The action plan should extend search and rescue to the exposure apartments if safe to do so.

The incident commander must also understand the resources required for search and rescue and extraction of the victim. Research conducted by the Phoenix and Seattle Fire Departments regarding search and rescue of downed firefighters determined that it took an average of 11-12 firefighters and 19-21 minutes to complete the search and "extraction" from the building. While this research was for a downed firefighter in a large building, it does reflect the realities of the time and resources needed to search, locate, and remove the (civilian) victim from the building. And, it likely will take more than a two-firefighter team to complete.

It should also be noted that the above research was conducted under simulated conditions. Removing a victim under actual fire conditions, with zero visibility, fire, smoke and heat, along with wet and debris littered floors will be more difficult and take longer.

The incident commander should also be aware of the affects of wind on fire development and intensity and the negative impact on occupant survival and search and rescue operation. Any wind over 10 mph begins to have increasingly dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increases risk to any firefighters downwind while in a building. The higher the wind speed the more intense the fire conditions. Once upwind windows fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building firefighters will be subject to a much greater blow torch affect than created by positive pressure ventilation.

Where wind conditions exists firefighters the incident commander may need to alter the old rule of "attacking fire from the unburned side" and attack the fire from the upwind side.

This Rule by no means suggests that primary search and rescue operations not be initiated. The Rule does, however, suggest there are fires conditions where the firefighter cannot penetrate and the victim cannot possible survive.

Bottom line; if the firefighters must wear PPE and SCBA to survive a toxic, 1,100 degree environment to rescue a victim, can the victim survive? If the occupant(s) cannot survive the search and *rescue event,* do not commit. Obtain fire control before searching.

Teaching Points

NO GO; If fire conditions prevent occupant survival, don't go. Obtain fire control.

- *As noted in the Section 5 under the "Firefighters Rules of Engagement for Survival" (and in Appendix A), today's fires kill occupants faster than a few decades ago. Because of significant amount of plastics in today's buildings, the fire atmosphere is far more toxic, fires are hotter, and flashover occurs sooner.*

- *Today's fire environment is far more toxic and lethal than the past. Victims die sooner than what was experienced a few decades ago. The old primary killer of fire victims was carbon monoxide.*

- *Today, the new killer in smoke is cyanide which is **30 times deadlier** faster than carbon monoxide. For example, the medical examiner in a firefighter fatality investigation stated he believed a firefighter who removed his face piece, or had it knocked off, had a carbon monoxide level in his blood that would have rendered him unconscious in 30 seconds and he would have stopped breathing in another 60 seconds.*

- Recent research by Underwriters Laboratories determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *Our goal is to save lives. The greatest risk taken by firefighter is during search and rescue operations. Therefore, risk must be based on the potential to save lives. No action plan can be accurately developed until we first determine if the victim can survive the fire conditions before rescuers reach them AND then survival their removal. If victim survival is not possible, a more cautious approach to fire operations must be taken. Control of the fire should be obtained before proceeding with the primary and secondary search efforts.*

- *The ultimate question to be considered in regard to survival profiling: If a firefighter cannot survive in the toxic environment without SCBA, and the PPE cannot withstand prolonged exposure above 500 degrees, what makes us think an occupant can survive similar conditions?*

- *No fire attack or building is worth the life of a firefighter.*

- *The prime factor in occupant survival profiling is based on evaluating fire conditions in individual "compartments" and determining if the victim can survive existing and projected fire conditions for the entire rescue event.*

- *An accurate determination of a survival profile will require a 360 degree size up.*

- *The incident commander must factor growing fire conditions, resources on scene (the number of firefighters to complete a rescue), and the time to complete a rescue into the decision to conduct and support search and rescue.*

- *Search and rescue and the related removal of the victim from the fire building takes time and most often occurs while fire conditions continue to deteriorate – sometimes rapidly, thus, increasing risk. The patient may not survive the toxic environment.*

- *The incident commander must determine if victims can survive conditions in individual compartments as part of decision making.*

- *If there is no potential for survival, the action plan should be based on that determination and the action plan must reduce firefighter risk exposure. Obtain fire control before extending search and rescue operations.*

- *Research conducted by the Phoenix and Seattle Fire Departments regarding search and rescue of downed firefighters determined that it took an average of 11-12 firefighters and an average of 19-21 minutes to complete the rescue and "extraction" from the building. While this research was for a downed firefighter in large buildings, it does reflect the realities that it will take time to search, find, and then remove the (civilian) victim from the building. And, it likely will take more than a two-firefighter team to complete.*

- *A fire in a home in the middle of the night, with fire showing out the rear window, and modest smoke throughout the rest of the building may allow victims survival.*

- *A fire in the same home in the middle of the night, with significant fire showing, and dense smoke under pressure pushing out all openings, may not allow any victims to survive the heat, toxic environment, and the time required to search and remove them. A more cautious approach should be taken in firefighting operations.*

- *A well involved structure will not allow for survival of any victims.*

- *A well involved fire in an apartment may not allow survival in the compartment, but the survival profile may be good in the adjacent apartment(s). The action plan should extend search and rescue to the exposure apartments if safe to do so.*

- *It must be understood that search and rescue takes time to complete-the patient may not survive the toxic environment and fire conditions may not improve during the rescue efforts. Be cautious*

- *Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.*

- *Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a downwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

- *Ultimately, the incident commander must consider; if the firefighters must wear PPE and SCBA to survive a toxic, 1,100 degree environment to rescue a victim, can the victim survive? If the occupant(s) cannot survive the search and rescue event, do not commit. Obtain fire control before searching.*

<u>SPECIAL NOTE:</u> See additional supporting research information regarding occupant survival profiling in the "Rules of Engagement for Firefighter Survival" under the "Determine the Occupant Survival Profile".

Also see appendix A for expanded research information on survival profiling.

SPECIAL NOTE: In an article titled "Survivability Profiling: Are victims Savable?, published in the December 2009 issue of Fire Engineering magazine, author Captain Stephen Marsar, of the Fire Department of New York cited the following study.

The Boston Globe newspaper, in 2005, examined federal investigation reports of 52 fires that killed 80 firefighters between 1997 and 2004. In only 14 of those 52 incidents was there even a suspicion of trapped occupants. In only 6 of those 52 incidents were people in the building at the time of the fire departments arrival and, once again, not one of those 52 fires resulted in a civilian fatality.

B. Dedman, Fewer Resources, Greater Risk for Firefighters, Boston Globe, January 31, 2005

What this research suggests is firefighters are dying in large numbers at fires where there are NO OCCUPANTS/VICTIMS were in the building. In order to increase firefighter survival, firefighters must seriously evaluate whether any occupants are actually in the building and thoroughly assess their survival profile.

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which the incident commander may not have considered that the present fire conditions made it unlikely that any occupants could survive the rescue event, including:

One Carrer Firefighter/Paramedic Dies and Part-time Firefighter is Injured When Caught in Residential Structure

NIOSH Case number F2010-10

On March 30, 2010, a 28-year-old male career fire fighter/paramedic (victim) died and a 21-year-old female part-time fire fighter/paramedic was injured when caught in an apparent flashover while operating a hoseline within a residence. Units arrived on scene to find heavy fire conditions at the rear of a house and moderate smoke conditions within the uninvolved areas of the house. A search and rescue crew had made entry into the house to search for a civilian who was entrapped at the rear of the house. The victim, the injured fire fighter/paramedic, and a third fire fighter made entry into the home with a charged 2 ½ inch hoseline. Thick, black rolling smoke banked down to knee level after the hoseline was advanced 12 feet into the kitchen area. While ventilation activities were occurring, the search and rescue crew observed fire rolling across the ceiling within the smoke. They immediately yelled to the hoseline crew to "get out." The search and rescue crew were able to exit the structure safely, then returned to rescue the injured fire fighter/paramedic first and then the victim. The victim was found wrapped in the 2 ½ inch hoseline that had ruptured and without his facepiece on. He was quickly brought out of the structure, received medical care on scene, and was transported to a local hospital where he was pronounced dead.

All fire companies were advised at dispatch and enroute that the civilian victim was in a wheel chair on an oxygen support system and the wheel chair was on fire.

Structure Fire Claims the Lives of Three Career Fire Fighters and Three Children – Iowa

http://www.cdc.gov/niosh/fire/pdfs/face200004.pdf

On December 22, 1999, a 49-year-old Shift Commander (Victim #1) and two Engine Operators, 39 and 29 years of age respectively (Victim #2 and Victim #3), lost their lives while performing search-and-rescue operations at a residential structure fire. At approximately 0824 hours, Central Dispatch was notified of a structure fire with three children possibly trapped inside. At approximately 0825 hours, a Shift Commander and an Engine Operator (Victim #1 and Victim #2) were dispatched to the scene. At 0827 hours, Engine 3 (Lieutenant and Victim #3) responded to the scene. **Aerial Truck 2 approaching the scene, reporting via radio that white to dark brown smoke was showing from the residence,** and requested six additional fire fighters**.** When Aerial Truck 2 arrived on the scene at 0830 hours, **Aerial Truck 2 witnessed a woman and child trapped on the porch roof, and they were informed that three children were trapped inside the house.** Victim #1 proceeded into the house to perform a search-and-rescue operation. Engine 3 arrived on the scene shortly after, and the Lieutenant connected a supply line to the hydrant as Victim #3 pulled the Engine into position. The Lieutenant and Victim #3 stretched a 5-inch supply line and connected it to Aerial Truck 2. At approximately 0831 hours, the Chief and Fire Fighter #1 arrived on the scene, and the Chief assumed Incident Command (IC). **At this time, one of the victims removed the first of the three children from the structure, handed the child to a police reserve officer near the front entrance of the structure, (the child was pronounce dead at the hospital) and returned to the structure to continue search and-rescue operations. At this time one of the victims removed a second child.** The IC grabbed the child and began cardiopulmonary resuscitation (CPR). Due to limited personnel on the fireground, the IC directed a police officer on the scene to transport him and the child to the hospital. After donning her gear, Fire Fighter #1 approached the front door and noticed that the 1½-inch handline (previously stretched) had been burned through and water was free-flowing. It is believed that the three victims were hit with a thermal blast of heat before the handline burned through. The three victims failed to exit as 12 additional fire fighters arrived on the scene began fire suppression and search-and-rescue operations. Victim #2 was located, removed, and transported to a nearby hospital, where he was pronounced dead. Victim #1 and Victim #3 were later found and pronounced dead on the scene.

NOTE: All three children were pronounced dead at the hospital

Volunteer Fire Fighter and Trapped Resident Die and a Volunteer Lieutenant is Injured following a Duplex Fire - Pennsylvania

http://www.cdc.gov/niosh/fire/pdfs/face200806.pdf

On February 29, 2008, a 21-year old male volunteer fire fighter (the victim) and a 33-year old volunteer Lieutenant were injured during a structural fire. **The fire fighters were attempting to locate and rescue a 44-year old female resident from a burning duplex. The fire fighters became trapped on the second floor when fire conditions deteriorated.** The victim was rescued by the rapid intervention

team (RIT) and both the victim and injured Lieutenant were transported to the hospital. The victim remained in critical condition for several days in the burn unit before succumbing to his injuries on March 5, 2008. **The female resident of the structure did not survive the fire.**

Conduct an Initial Risk Assessment and Implement a SAFE ACTION PLAN

Objective: To cause the incident commander to develop a safe action plan by conducting a size-up, assess the occupant survival profile and completing a risk assessment *before* firefighters are placed in high risk positions on the fireground.

No Go: Don't commit crews to the interior if you don't have an action plan.

Narrative

The incident commander must have a logical vision as to what is burning, where it is, and where it's likely to travel, along with a reasonable calculation of what fire crews can accomplish safely. This vision must be transferred to an action plan.

The incident action plan lays out where the incident commander intends to go. The foundation of a good action is the completion of the 360 degree size up and the occupant survival profile. The first priority of the action plan is to ensure firefighter safety. Ultimately, the action plan should select the correct strategy and build a command organization that covers all the critical areas of the fireground with adequate resources.

There are also a number of critical factors that must be assessed in developing an action plan and they include; building size, arrangement and access, fire location and extension, wind speed and direction, ventilation profile, savable lives and property, resources, adequate firefighter staffing and water supply. All seven sides of the structure must be evaluated; four sides, interior, top and bottom. Evaluating these factors will allow the incident commander to forecast future conditions.

The risk assessment parallels the size up and determines what level of risk is acceptable based on conditions and resources available. Key elements to the assessment include applying the fire departments existing risk management plan (SOP's/SOG's) that guides the evaluation of the critical factors based on local and past experience. Other components include evaluating lives to be saved, savable property, and recognizing what is about to be lost or is already lost. The Rules of Engagement serve as an excellent risk assessment tool that will improve fireground safety.

Once the risk and critical factors are considered the appropriate strategy can be selected – offensive, marginal, or defensive. The strategy determines the objectives and tasks to be assigned crews to obtain incident stabilization. Selecting an offensive strategy with defensive fire conditions puts firefighters at extreme risk. A marginal strategy would be used only when fire conditions unexpectedly rapidly deteriorate following initial offensive operations (caught by surprise) and its purpose is to allow firefighters to exit the building as soon as possible. It may also be used (very short term) when a savable life is confirmed (i.e. victim hanging out the window). Conditions will be deteriorating rapidly and the window of success will be very short and this operation must be very closely monitored by the incident

commander. A marginal strategy should never be used for any other purpose. Any “Hail Mary’s” should be reserved for football.

The development of the incident action plan begins with the initial incident commander – most often a company officer. The initial action plan is generally a basic plan based on limited intelligence collected within the time frame before a chief officer arrives on scene. The plan must have the correct strategy. As a chief officer assumes command, that officer must confirm the correct strategy and continue the size up process and refine and broaden the plan based on his ability to collect progress reports and build an effective command organization. As the fire progresses fire conditions will either improve or worsen. If conditions deteriorate, the incident commander must be prepared to rapidly evacuate the building before firefighters are harmed.

The incident commander must recognize that the action plan is fluid and changes with fire conditions and information. It’s important the incident commander maintain on-going situational awareness and stays ahead of the fire.

Until the proper strategy is confirmed and a solid action plan is developed the incident commander should be very cautious about assigning a crew to what might be considered a high risk position.

The action plan also includes obtaining the four critical benchmarks for firefighting operations; personnel accountability reports (PAR’s), completion of primary search operations (all clear), obtain fire control (fire control) and when the fire is no longer causing damage (loss stopped). The incident commander must check off each benchmark as the incident progresses.

Recent research by Underwriters Laboratory’s determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today’s typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

The incident commander should also be aware of the affects of wind on fire development and intensity in the action planning process. Any wind over 10 mph begins to have increasing dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increase risk to any firefighters downwind while in a building. The higher the wind speed the more intense the fire conditions. Once downwind windows fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building

firefighters will be subject to a much greater blow torch affect than created by positive pressure ventilation.

Where wind conditions exists firefighters the incident commander may need to alter the old rule of "attacking fire from the unburned side" and attack the fire from the upwind side.

Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.

Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.

Bottom line: If the incident commander doesn't have a risk assessment or action plan, he's freelancing and firefighters are put at great risk.

Teaching Points

- *The incident commander must have a logical vision as to what is burning, where it is, and where it's likely to travel, along with a reasonable calculation of what fire crews can accomplish safely. This vision must be transferred to an action plan.*

- *Obtaining a 360 size-up and assessing the occupant survival profile will provide information on fire conditions and a risk assessment that will allow the incident commander to develop a more accurate, and safe, initial action plan.*

- *There are also a number of critical factors that must be assessed in developing an action plan and they include; building size, arrangement and access, wind speed and direction, fire location and extension, ventilation profile, savable lives and property, resources, adequate firefighter staffing and water supply.*

- *All seven sides of the structure must be evaluated; four sides, interior, top and bottom. Evaluating these factors will allow the incident commander to forecast future conditions.*

- *Until these two critical factors are determined safe action plan cannot be developed. The occupant survival profile, for example will determine what level of risk which may be allowed.*

- *The first companies or officers to an assigned geographic location or function MUST provide an initial size up of their assigned position report to the incident commander.*

- *The incident commander must be able to forecast where the fire is progressing, or likely to travel, and a consideration of time lines, along with a reasonable calculation of what fire crews can accomplish safely (or not accomplish) when developing the action plan.*

- *Once the risk and critical factors are considered the appropriate strategy can be selected – offensive, marginal, or defensive. The strategy determines the objectives and tasks to be assigned crews to obtain incident stabilization.*

- *Selecting an offensive strategy with defensive fire conditions puts firefighters at extreme risk.*

- *A marginal strategy should be used only when fire conditions unexpectedly rapidly deteriorate following initial offensive operations (caught by surprise) and its purpose is to allow firefighters to exit the building as soon as possible. It may also be used (very short term) when a savable life is confirmed (i.e. victim hanging out the window).*

- *Ongoing progress reports will continue to provide information critical to the plan and decision making as well as revisions to the action plan.*

- *The action plan, and all commitment of fire crews, must consider the safety of firefighters as the highest priority.*

- *The action plan is a fluid plan that will change with time, fire conditions, and resources. In order to keep the plan current the incident commander must obtain frequent progress reports and maintain situational awareness of all that is happening on the fireground.*

- *Recent research by Underwriters Laboratories determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.*

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover,* ***the time from onset of untenability to flashover was less***

than 10 seconds! *This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a downwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

- *Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.*

- *Abandoned and dilapidated buildings are a special consideration for a no-go decision. Where an active and progressing fire is present, and the fire is not rapidly knocked down, a defensive strategy should be seriously considered from the outset.*

- ***No fire attack is worth the life of a firefighter. Period!***

- *The ultimate question to be considered in regard to survival profiling: If a firefighter cannot survive in the toxic environment without SCBA, and the PPE cannot withstand prolonged exposure above 500 degrees, what makes us think an occupant can survive similar conditions?*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which the incident commander did not conduct a thorough size-up, thoroughly assess the occupant survival profile and complete a full risk assessment before placing fire fighters in high risk positions, including:

Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom – South Carolina;

http://www.cdc.gov/niosh/fire/reports/face200718.html

On June 18, 2007, nine career fire fighters (all males, ages 27 – 56) died when they became disoriented and ran out of air in rapidly deteriorating conditions inside a burning commercial furniture showroom and warehouse facility. **The first arriving engine company found a rapidly growing fire at the enclosed loading dock connecting the showroom to the warehouse.** The Assistant Chief entered the main showroom entrance at the front of the structure but did not find any signs of fire or smoke in the main showroom. He observed fire inside the structure when a door connecting the rear of the right showroom addition to the loading dock was opened. **Within minutes, the fire rapidly spread into and above the main showroom, the right showroom addition, and the warehouse. The burning furniture quickly generated a huge amount of toxic and highly flammable gases along with soot and products of incomplete combustion that added to the fuel load. The fire overwhelmed the interior attack and the**

interior crews became disoriented when thick black smoke filled the showrooms from ceiling to floor. The interior fire fighters realized they were in trouble and began to radio for assistance as the heat intensified. One fire fighter activated the emergency button on his radio. The front showroom windows were knocked out and fire fighters, including a crew from a mutual-aid department, were sent inside to search for the missing fire fighters. Soon after, the flammable mixture of combustion by-products ignited, and fire raced through the main showroom. **Interior fire fighters were caught in the rapid fire progression and nine fire fighters from the first-responding fire department died**. At least nine other fire fighters, including two mutual-aid fire fighters, barely escaped serious injury.

Structure Fire Claims the Lives of Three Career Fire Fighters and Three Children – Iowa

http://www.cdc.gov/niosh/fire/pdfs/face200004.pdf

On December 22, 1999, a 49-year-old Shift Commander (Victim #1) and two Engine Operators, 39 and 29 years of age respectively (Victim #2 and Victim #3), lost their lives while performing search-and-rescue operations at a residential structure fire. At approximately 0824 hours, Central Dispatch was notified of a structure fire with three children possibly trapped inside. At approximately 0825 hours, a Shift Commander and an Engine Operator (Victim #1 and Victim #2) were dispatched to the scene. At 0827 hours, Engine 3 (Lieutenant and Victim #3) responded to the scene. **Aerial Truck 2 approaching the scene, reporting via radio that white to dark brown smoke was showing from the residence, and requested six additional fire fighters. When Aerial Truck 2 arrived on the scene at 0830 hours, 2 witnessed a woman and child trapped on the porch roof, and they were informed that three children were trapped inside the house.** Victim #1 proceeded into the house to perform a search-and-rescue operation. Engine 3 arrived on the scene shortly after, and the Lieutenant connected a supply line to the hydrant as Victim #3 pulled the Engine into position. The Lieutenant and Victim #3 stretched a 5-inch supply line and connected it to Aerial Truck 2. At approximately 0831 hours, the Chief and Fire Fighter #1 arrived on the scene, and the Chief assumed Incident Command (IC). **At this time, one of the victims removed the first of the three children from the structure, handed the child to a police reserve officer near the front entrance of the structure, (the child was pronounced dead at the hospital)** and returned to the structure to continue search and-rescue operations. At this time one of the victims removed a second child. The IC grabbed the child and began cardiopulmonary resuscitation (CPR). Due to limited personnel on the fireground, the IC directed a police officer on the scene to transport him and the child to the hospital. **After donning her gear, Fire Fighter #1 approached the front door and noticed that the 1½-inch hoseline (previously stretched) had been burned through and water was free-flowing. It is believed that the three victims were hit with a thermal blast of heat before the hoseline burned through. The three victims failed to exit as 12 additional fire fighters arrived on the scene began fire suppression and search-and-rescue operations.** Victim #2 was located, removed, and transported to a nearby hospital, where he was pronounced dead. Victim #1 and Victim #3 were later found and pronounced dead on the scene.

Career Fire Captain Dies When Trapped by Partial Roof Collapse in a Vacant House Fire – Texas

http://www.cdc.gov/niosh/fire/pdfs/face200509.pdf

On February 19, 2005, a 39-year-old career fire Captain (the victim) died after **being trapped by the partial collapse of the roof of a vacant one-story wood frame dwelling. The house was abandoned and known by residents in the area to be a "crack house" at the time of the incident.** The victim was the captain on the first-arriving engine crew which was assigned to perform a "fast attack" – to take a hoseline into the house, locate the seat of the fire, and begin extinguishment. The one-story wooden ranch-style house was built in the 1950s and additional rooms had been added at the rear in at least two phases following the initial construction. **Crews arriving on scene could see fire venting through the roof at the rear of the house.** The victim and a fire fighter advanced the initial attack line through the front entrance and made their way toward the rear of the house. Visibility was good in the front of the house but conditions quickly changed as they advanced toward the rear. **The fast attack crew had just begun to direct water onto the burning ceiling in the kitchen and den areas when the roof at the rear of the structure (over the building additions) collapsed, trapping the captain under burning debris**. The collapse pushed fire toward the front of the house which quickly ignited carbon and dust particles suspended in the air along with combustible gases, sending a fireball rolling toward the front of the structure. Prior to the time of the collapse, two other crews had entered through the front entrance. **The rapidly deteriorating conditions following the collapse quickly engulfed the other crews with fire. Crew members became disoriented and crews became separated as they attempted to find their way out. Five fire fighters received burns requiring medical attention.**

NEAR MISS REPORTS

Report#07-749

A hose team entered a two story single family structure with **a well involved roof/attic fire**. Prior to the hose team entering the building, **a deck gun had been used to control the fire**. A portion of the second floor ceiling collapsed and briefly trapped a member. The member was easily removed and exited the building with a strained neck. **The hose team entered the building before an Incident Action Plan had been established and argued with the Incident Commander about defensive tactics**. **The Safety Officer advised the duty captain to exit the building but the captain was convinced that an offensive attack was warranted. The building was not occupied by civilians.**

If You Do Not Have the Resources to Safely Support and Protect Firefighters, Seriously Consider a Defensive Strategy.

Objective: To prevent the commitment of firefighters to high risk tactical objectives that cannot be accomplished safely due to inadequate resources on the scene.

Narrative

Adequate resources are needed for prompt incident stabilization. Simply put; a lot of resources equals a lot accomplished. Little resources equals little success.

The incident commander must recognize the limits of his desired action plan based on available resources to fight the fire. “Adequate resources” s include the number of firefighters on scene and when others will arrive, apparatus capabilities, proper size and number of hoselines or high caliber apparatus mounted monitors required, and a secure water supply along with an adequate number of chief officers to fill the needed division and group command positions. The level of resources present has a great influence on which strategy is selected. Firefighters will be placed at great risk with an offensive strategy if resources are too little, or arrive too late.

Even large urban fire departments, experience fires are beyond their capabilities. Smaller suburban or rural fire departments with limited resources and a significant fire cannot possibly expect the same firefighting success as the larger urban fire departments. The action plan must be adjusted to fit this reality. Two or three fire companies, staffed with two or three members each, along with longer response times cannot be expected to complete the same work as the NFPA 1710 standard recommendation of 17 members on the scene as part of the initial response to a structure fire.

In order to obtain adequate resources the incident commander must request additional alarms, or mutual aid, necessary to achieve incident stabilization safely in a timely fashion. It’s better to request a second alarm early rather than later. What is eventually not used can be returned to service. The incident commander should NEVER “piece-meal” special call one or two fire companies at a time. Too much resource on scene is better than too little. A wise incident commander will also maintain one or more companies in reserve at staging until the incident is deemed stabilized.

Clearly, the incident commander must limit firefighter risk exposure to what can be accomplish safely, including the “write off” portions of the building and concentrating on what can be saved, or going to defensive operations immediately.

Conducting search and rescue, along with interior firefighting operations, where there is significant fire in the building, and inadequate resources on scene, places firefighters in the interior at extreme risk. The incident commander must seriously consider a defensive strategy.

Compliance with the OSHA ”two in, two out” rule should never be violated at a working fire and the establishment of a fully staffed Rapid Intervention Team beyond the simplest fires is a must to maximize firefighter safety and survival.

Bottom line: The incident commander must match resources to fire conditions. If there is more fire than resources, the incident commander must consider defensive operations.

Teaching Points

- *“Adequate resources” means an adequate numbers of firefighters to effectively engage the fire, the proper size and number of hoselines, and a secure (hydrant) water supply along with an adequate number of chief officers to fill the needed division and group command positions.*

- *One or two fire crews, with two or three members each, cannot be expected to complete the same work as the NFPA 1710 standard recommendation of 17 members on the scene as part of the initial response to a structure fire.*

- *Many times, the fire is in an advanced stage, complex, or exceeds the o scene resources for some period of time. The incident commander must adjust the action plan that reflects this reality and keep firefighters safe.*

- *Conducting search and rescue, along with interior firefighting operations, where there is significant fire in the building, with inadequate resources on scene, places firefighters in the interior at extreme risk.*

- *Delays in the arrival of additional enroute resources also extends the high risk environment for firefighters engaged in interior operations.*

- *If on scene resources are not adequate to effectively conduct search and rescue and control the fire and support a RIT, limit the risk exposure of firefighters. Seriously consider an early defensive operation.*

- *Fire control should be obtained before interior operations or search and rescue operations are initiated.*

- *Where inadequate resources exist, fire control should be obtained (defensive) before interior operations are initiated.*

- *The incident commander, and firefighters, must recognize we cannot always save people or buildings when we do not have the resources on scene to do so.*

- *Compliance with the OSHA "two in, two out" rule should never be violated at a working fire and the establishment of a fully staffed Rapid Intervention Team beyond the simplest fire is a must to maximize firefighter safety and survival.*

- *In order to obtain the necessary resources, the incident commander must request additional resources (multiple alarms or mutual aid) early and before all on scene resources are consumed.*

- *The incident commander should NEVER piece meal requests for one on two fire companies at a time. Too much resource is better than too little. It's wise for the incident commander to maintain reserve companies in staging until it is clearly determined that they will not be needed.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which the lack of adequate staffing on scene was a contributing factor to fire fighter LODDs including:

Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom – South Carolina;

http://www.cdc.gov/niosh/fire/reports/face200718.html

On June 18, 2007, nine career fire fighters (all males, ages 27 – 56) died when they became disoriented and ran out of air in rapidly deteriorating conditions inside a burning commercial furniture showroom and warehouse facility. The first arriving engine company found a rapidly growing fire at the enclosed loading dock connecting the showroom to the warehouse. The Assistant Chief entered the main showroom entrance at the front of the structure but did not find any signs of fire or smoke in the main showroom. He observed fire inside the structure when a door connecting the rear of the right showroom addition to the loading dock was opened. **Within minutes, the fire rapidly spread into and above the main showroom, the right showroom addition, and the warehouse. The burning furniture quickly generated a huge amount of toxic and highly flammable gases along with soot and products of incomplete combustion that added to the fuel load. The fire overwhelmed the interior attack and the interior crews became disoriented when thick black smoke filled the showrooms from ceiling to floor.** The interior fire fighters realized they were in trouble and began to radio for assistance as the heat intensified. One fire fighter activated the emergency button on his radio. The front showroom windows were knocked out and fire fighters, including a crew from a mutual-aid department, were sent inside to search for the missing fire fighters. Soon after, the flammable mixture of combustion by-products ignited, and fire raced through the main showroom. Interior fire fighters were caught in the rapid fire progression and nine fire fighters from the first-responding fire department died. At least nine other fire fighters, including two mutual-aid fire fighters, barely escaped serious injury.

Structure Fire Claims the Lives of Three Career Fire Fighters and Three Children – Iowa

http://www.cdc.gov/niosh/fire/pdfs/face200004.pdf

On December 22, 1999, a 49-year-old Shift Commander (Victim #1) and two Engine Operators, 39 and 29 years of age respectively (Victim #2 and Victim #3), lost their lives while performing search-and-rescue operations at a residential structure fire. At approximately 0824 hours, Central Dispatch was notified of a structure fire with three children possibly trapped inside. At approximately 0825 hours, a Shift Commander and an Engine Operator (Victim #1 and Victim #2) were dispatched to the scene. At 0827 hours, Engine 3 (Lieutenant and Victim #3) responded to the scene. **Aerial Truck 2 approaching the scene, reporting via radio that white to dark brown smoke was showing from the residence,** and requested six additional fire fighters**.** When Aerial Truck 2 arrived on the scene at 0830 hours, **Aerial Truck 2 witnessed a woman and child trapped on the porch roof, and they were informed that three children were trapped inside the house.** Victim #1 proceeded into the house to perform a search-and-rescue operation. Engine 3 arrived on the scene shortly after, and the Lieutenant connected a supply line to the hydrant as Victim #3 pulled the Engine into position. The Lieutenant and Victim #3 stretched a 5-inch supply line and connected it to Aerial Truck 2. At approximately 0831 hours, the Chief and Fire Fighter #1 arrived on the scene, and the Chief assumed Incident Command (IC). **At this time, one of the victims removed the first of the three children from the structure, handed the child to a police reserve officer near the front entrance of the structure, (the child was pronounce dead at the hospital) and returned to the structure to continue search and-rescue operations. At this time one of the victims removed a second child.** The IC grabbed the child and began cardiopulmonary resuscitation (CPR). Due to limited personnel on the fireground, the IC directed a police officer on the scene to transport him and the child to the hospital. After donning her gear, Fire Fighter #1 approached the front door and noticed that the 1½-inch hoseline (previously stretched) had been burned through and water was free-flowing. It is believed that the three victims were hit with a thermal blast of heat before the hoseline burned through. The three victims failed to exit as 12 additional fire fighters arrived on the scene began fire suppression and search-and-rescue operations. Victim #2 was located, removed, and transported to a nearby hospital, where he was pronounced dead. Victim #1 and Victim #3 were later found and pronounced dead on the scene.

NOTE: All three children were pronounced dead at the hospital

Volunteer Fire Fighter Dies While Lost in Residential Structure Fire-Alabama

http://www.cdc.gov/niosh/fire/pdfs/face200834.pdf

On October 29, 2008, a 24-year old male volunteer fire fighter (the victim) was fatally injured while fighting a residential structure fire. **The victim, one of three fire fighters on scene, entered the residential structure by himself through a carport door with a partially charged 1½-in hose line; he became lost in thick black smoke.** The victim radioed individuals on the fireground to get him out. Fire fighters were unable to locate the victim after he entered the structure which became engulfed in flames. The victim was caught in a flashover and was unable to escape the fire. Approximately an hour after the victim entered the structure alone, a police officer looking through the kitchen window noticed the victim's hand resting on a kitchen counter; the victim was nine feet from the carport door he had entered.

NEAR MISS REPORTS

Report #09-364

On the morning of [date and time deleted], we received an alarm of a structure fire about ½ mile from Station [1]. Engine [1], Engine [2] and Rescue [1] responded.

Upon the arrival of Engine [1] and Rescue [1] we found heavy smoke showing from the structure. Engine [1] laid two 1 ¾" lines and caught the hydrant right across the street. **Engine [1] group went in through the front door, but due to extreme amount of heat, were not able to get to the seat of the fire. Group 1 lieutenant called for vertical ventilation but due to staffing issues, ventilation was not able to be performed.**

Our chief arrived on scene and assumed command. He advised us to exit the building and we were going defensive. After exiting the house, group 1 pulled their line to the C-side of the structure and Group 2 (off of Engine [2]) pulled the second 1 ¾" to the B-side of the structure. The Incident Commander then advised the first arriving off duty personnel to set up the PPV fan at the front door. Once two off-duty personnel arrived, they became Group 3 and set up and turned on the fan. The structure was an old [deleted] house built in the early 1900s with a very big and open attic. After the smoke cleared, the Incident Commander advised Group1 and 2 to stop flowing water because Group 3 was going in the front door and we were going back offensive.

Due to heavy fire, Group 3 was doing no good and backed out. Two more off-duty personnel arrived and the Incident Commander made them Group 4 and assigned them to vertically ventilate. This order was given 45 minutes into the fire and approximately 30 minutes after a defensive attack was ordered and the PPV fan was set up. The roof was already visibly sagging and from the road you could see heavy fire in the attic. Three lieutenants and a captain on scene advised the Incident Commander that the task was unsafe. Group 4 ignored our plea and put a ladder on the building. Once on the roof and starting to ventilate, the roof gave way and collapsed. The two firefighters in Group 4 were standing on the roof ladder and were able to roll off the house. The roof ladder sustained major fire damage and the firefighter making the cuts was very lucky that his back up firefighter was holding onto him and saw the roof start to give way. This allowed for the backup firefighter to pull the [power saw operator] up and fall off the rood onto the ground instead of into the fire.

After it was over, the firefighters from Group 4 stated that the Incident Commander ordered us to ventilate and we were not going to break an order."

DO NOT Risk Firefighter Lives for Property That Cannot Be Saved. Seriously Consider a Defensive Strategy.

Objective: To prevent the commitment of firefighters to high risk search and rescue and firefighting operations that may harm them when fire conditions prevent occupant survival and significant or total destruction of the building is inevitable.

Narrative

Part of the risk assessment is the determining what can, and cannot, be saved. This will allow the incident commander to determine the correct strategy and tactics to be employed.

Our goal as firefighters is to save lives. But the incident commander must recognize that we cannot always save a life. If conditions indicate occupants cannot survive current and projected fire conditions in the search "compartment", then primary search and rescue operations should be suspended until the fire is controlled.

The incident commander must also recognize that we cannot always save a building. Those that are lost are generally rebuilt after the fire. No fire attack or building is worth the life of a firefighter. Yet, NIOSH firefighter fatality reports are full of cases where firefighters were killed while operating in buildings where fire conditions would be clearly defined as defensive fires.

If conditions indicate occupant survival is not possible or the building is lost to fire, the incident commander must consider write of sections of the building lost, or the entire building and change the strategy and seriously consider defensive operations. Fire control should be obtained before any search and rescue operations begin. If interior operations are already underway firefighters must be immediately withdrawn and operate from safe exterior positions. The incident commander must also recognize it often takes longer to evacuate crews than it took them to penetrate to their operating positions. The call to evacuate must occur before the fire can harm them. Appropriate large caliber hose streams, or monitors, from exterior positions should be employed to obtain fire control.

Buildings that are lost are often well involved with fire or fire in sections of the building is advancing rapidly to take the building. In these cases large caliber hoselines or apparatus mounted monitor streams should be considered to achieve a rapid and safe knockdown of the fire before extending interior operations and search and rescue.

The incident commander must understand that the structural integrity of a well involved building will be compromised. These fire conditions eat away at the buildings structural and can exposé the firefighter to the risk of roof, floor, or total building collapse during later interior operations or overhaul. Structural integrity must be re-assessed before re-assessed.

As another example for the need for the correct strategy is research conducted by the Boston Globe newspaper, in 2005, which examined federal investigation reports of 52 fires that killed 80 firefighters between 1997 and 2004. In only 14 of those 52 incidents was there even a suspicion of trapped

occupants. In only 6 of those 52 incidents were people in the building at the time of the fire departments arrival and not one of those 52 fires resulted in a civilian fatality.

What this research suggests is firefighters are dying in large numbers at fires where there were NO OCCUPANTS/VICTIMS were in the building. In order to increase firefighter survival, firefighters must seriously evaluate whether any occupants are actually in the building and thoroughly assess their survival profile.

The change to a defensive strategy requires a change in the action plan. The first priority of the action plan should be to protect firefighters. The incident commander should not extend risk for what is already lost. The incident commander must quickly obtain progress reports from all points on the fireground, conduct a fresh risk assessment, and update the action plan.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

The incident commander should also be aware of the affects of wind driven fires on fire development and intensity. Any wind over 10 mph begins to have increasing dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increase risk to any firefighters downwind while in a building. The higher the wind speed the more intense the fire conditions. Once downwind windows fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building firefighters will be subject to a much greater blow torch affect than created by positive pressure ventilation.

The incident commander must also consider the possibility of lightweight construction and early collapse potential. Underwriters Laboratory test determined some lightweight unprotected floor truss systems can collapse in 6.5 minutes after flame impingement – and without warning. This short time frame means collapse could occur as the first crews are entering the building.

Abandoned and dilapidated buildings are also a particular risk to firefighters and experience has shown there is very little likelihood that there are any occupants in the building. Should there be any active and growing fire in such a building which cannot be immediately controlled then a defensive strategy must be seriously considered at the outset.

Bottom line: If fire conditions prevent an occupant from surviving a rescue event or the fire has, or will, destroy the building, the action plan should protect firefighters. Go defensive.

Recent research by Underwriters Laboratory's determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

Teaching Points

NO GO: If fire conditions prevent occupant survival, adjust the action plan to minimize risk.

NO GO: If the fire has, or will destroy the building, adjust the action plan and minimize risk.

- *The incident commander must recognize that we cannot always save a life.*
- *The incident commander must recognize that we cannot always save a building.*
- *Where both are lost, all that remains is to stop extension and knock down and extinguish the fire in a safe manner. Buildings that are lost nearly always are re-built.*
- *No fire attack or building or fire attack is worth the life of a firefighter. Most buildings will be re-built.*
- *If conditions indicate there is no occupant survival possible, or the building is already lost to fire, or fire conditions will take the building, DO NOT place firefighters at risk. The action plan should protect firefighters. Consider early defensive operations and obtain fire control before firefighters are allowed to enter the building.*
- *The Boston Globe newspaper, in 2005, which examined federal investigation reports of 52 fires that killed 80 firefighters between 1997 and 2004. In only 14 of those 52 incidents was there even a suspicion of trapped occupants. In only 6 of those 52 incidents were people in the building at the time of the fire departments arrival and not one of those 52 fires resulted in a civilian fatality.*
- *What this research suggests is firefighters are dying in large numbers at fires where there were NO OCCUPANTS/VICTIMS were in the building. In order to increase firefighter survival, firefighters must seriously evaluate whether any occupants are actually in the building and thoroughly assess their survival profile.*
- *Recent research by Underwriters Laboratories determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover*

time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover,* ***the time from onset of untenability to flashover was less than 10 seconds!*** *This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.*

- *Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a upwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

- *Any time the building is determined it cannot be saved large caliber hose streams or apparatus mounted monitor streams should be considered to achieve a rapid and safe knockdown of the fire before extending interior operations and search and rescue.*

- *Following fire control from exterior operations the incident commander and the safety officer must conduct a thorough risk assessment of the buildings structural integrity for safe operations before entry is permitted*

- *It is the incident commander's responsibility to control firefighters on the fireground and ensure they are not engaging in independent or freelance activities that put them at risk (particularly when the incident is determined to be a defensive operation).*

- *This Rule does not suggest that no action be taken. Rather, a more cautious approach should be taken to ensure firefighter safety.*

- *The incident commander, because of an exterior view, often is in the best position to determine if the fire is defensive from the outset. If after the initial fire attack is mounted and conditions continue to deteriorate, the incident commander must seriously consider a defensive strategy.*

- *The incident commander must continuously monitor changing conditions and not hesitate to declare the fire a defensive operation and immediately evacuate crews from the building if conditions worsen.*

- *The incident commander must understand it often takes longer to evacuate crews than it took them to penetrate to their operating positions. The call for an evacuation must occur before the fire can harm firefighters.*

- *After ordering an evacuation of the building the incident commander must conduct a "round robin" radio call to all Division/Group Supervisors and/or fire crews to confirm they understand the fire is now defensive and that all crews are indeed evacuating the building and have done so. Once evacuation is complete a Personnel Accountability Report (PAR) roll call must be conducted to confirm all firefighters are out of the building.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which the incident commander committed firefighters to high risk operations at structures with minimal value and conditions indicated occupant survival was unlikely, and the building could not be saved, including:

Structure Fire Claims the Lives of Three Career Fire Fighters and Three Children – Iowa

http://www.cdc.gov/niosh/fire/pdfs/face200004.pdf

On December 22, 1999, a 49-year-old Shift Commander (Victim #1) and two Engine Operators, 39 and 29 years of age respectively (Victim #2 and Victim #3), lost their lives while performing search-and-rescue operations at a residential structure fire. At approximately 0824 hours, Central Dispatch was notified of a structure fire with three children possibly trapped inside. At approximately 0825 hours, a Shift Commander and an Engine Operator (Victim #1 and Victim #2) were dispatched to the scene. At 0827 hours, Engine 3 (Lieutenant and Victim #3) responded to the scene. **Aerial Truck 2 approaching the scene, reporting via radio that white to dark brown smoke was showing from the residence,** and requested six additional fire fighters**.** When Aerial Truck 2 arrived on the scene at 0830 hours, **Aerial Truck 2 witnessed a woman and child trapped on the porch roof, and they were informed that three children were trapped inside the house.** Victim #1 proceeded into the house to perform a search-and-rescue operation. Engine 3 arrived on the scene shortly after, and the Lieutenant connected a supply line to the hydrant as Victim #3 pulled the Engine into position. The Lieutenant and Victim #3 stretched a 5-inch supply line and connected it to Aerial Truck 2. At

approximately 0831 hours, the Chief and Fire Fighter #1 arrived on the scene, and the Chief assumed Incident Command (IC). **At this time, one of the victims removed the first of the three children from the structure, handed the child to a police reserve officer near the front entrance of the structure, (the child was pronounce dead at the hospital) and returned to the structure to continue search and-rescue operations. At this time one of the victims removed a second child.** The IC grabbed the child and began cardiopulmonary resuscitation (CPR). Due to limited personnel on the fireground, the IC directed a police officer on the scene to transport him and the child to the hospital. After donning her gear, Fire Fighter #1 approached the front door and noticed that the 1½-inch hoseline (previously stretched) had been burned through and water was free-flowing. It is believed that the three victims were hit with a thermal blast of heat before the hoseline burned through. The three victims failed to exit as 12 additional fire fighters arrived on the scene began fire suppression and search-and-rescue operations. Victim #2 was located, removed, and transported to a nearby hospital, where he was pronounced dead. Victim #1 and Victim #3 were later found and pronounced dead on the scene.

NOTE: All three children were pronounced dead at the hospital

Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom – South Carolina;

http://www.cdc.gov/niosh/fire/reports/face200718.html

On June 18, 2007, nine career fire fighters (all males, ages 27 – 56) died when they became disoriented and ran out of air in rapidly deteriorating conditions inside a burning commercial furniture showroom and warehouse facility. **The first arriving engine company found a rapidly growing fire at the enclosed loading dock connecting the showroom to the warehouse.** The Assistant Chief entered the main showroom entrance at the front of the structure but did not find any signs of fire or smoke in the main showroom. He observed fire inside the structure when a door connecting the rear of the right showroom addition to the loading dock was opened. **Within minutes, the fire rapidly spread into and above the main showroom, the right showroom addition, and the warehouse. The burning furniture quickly generated a huge amount of toxic and highly flammable gases along with soot and products of incomplete combustion that added to the fuel load. The fire overwhelmed the interior attack and the interior crews became disoriented when thick black smoke filled the showrooms from ceiling to floor. The interior fire fighters realized they were in trouble and began to radio for assistance as the heat intensified.** One fire fighter activated the emergency button on his radio. The front showroom windows were knocked out and fire fighters, including a crew from a mutual-aid department, were sent inside to search for the missing fire fighters. Soon after, the flammable mixture of combustion by-products ignited, and fire raced through the main showroom. Interior fire fighters were caught in the rapid fire progression and nine fire fighters from the first-responding fire department died. At least nine other fire fighters, including two mutual-aid fire fighters, barely escaped serious injury.

Career Fire Captain Dies When Trapped by Partial Roof Collapse in a Vacant House Fire – Texas

http://www.cdc.gov/niosh/fire/pdfs/face200509.pdf

On February 19, 2005, a 39-year-old career fire Captain (the victim) **died after being trapped by the partial collapse of the roof of a vacant one-story wood frame dwelling. The house was abandoned and known by residents in the area to be a "crack house" at the time of the incident**. The victim was the captain on the first-arriving engine crew which was assigned to perform a "fast attack" – to take a hoseline into the house, locate the seat of the fire, and begin extinguishment. The one-story wooden ranch-style house was built in the 1950s and additional rooms had been added at the rear in at least two phases following the initial construction. Crews arriving on scene could see fire venting through the roof at the rear of the house. The victim and a fire fighter advanced the initial attack line through the front entrance and made their way toward the rear of the house. Visibility was good in the front of the house but **conditions quickly changed as they advanced toward the rear. The fast attack crew had just begun to direct water onto the burning ceiling in the kitchen and den areas when the roof at the rear of the structure (over the building additions) collapsed, trapping the captain under burning debris. The collapse pushed fire toward the front of the house which quickly ignited carbon and dust particles suspended in the air along with combustible gases, sending a fireball rolling toward the front of the structure.** Prior to the time of the collapse, two other crews had entered through the front entrance. The rapidly deteriorating conditions following the collapse quickly engulfed the other crews with fire. Crew members became disoriented and crews became separated as they attempted to find their way out. Five fire fighters received burns requiring medical attention.

Volunteer Fire Lieutenant Killed While Fighting a Basement Fire - Pennsylvania

http://www.cdc.gov/niosh/fire/pdfs/face200808.pdf

On March 5, 2008, a 35-year-old male volunteer Fire Lieutenant (the victim) died while fighting a basement fire. **About 30 minutes after the fire call had been dispatched and the crews had been evacuated from the structure and accounted for, a decision was made to re-enter the structure to try and extinguish the fire.** The victim, an Assistant Chief (AC), and a Captain had made their way down an interior stairway to the basement area where the victim opened a 1 ¾-inch hoseline. Shortly thereafter, the Captain told the AC that he had to exit the basement stairs. A few seconds later, the AC told the victim to shut down the line and evacuate the basement because the fire was intensifying. The AC was second up the stairs and told a fire fighter at the top of the stairway landing that the victim was coming up behind him. The AC exited the structure while the fire fighter stayed at the top of the stairway and yelled several times to the victim, but received no response. The fire fighter exited the structure and informed the AC that the victim had not come up from the basement. The AC then notified the Incident Commander who activated a rapid intervention (RIT) team. The RIT made entry into the structure but was repelled by the intensity of the fire. After several more rescue attempts, the victim was removed from the building and later pronounced dead at the hospital. Four other fire fighters were treated for minor injuries and were released from the hospital. The following factors were identified as contributing to the incident: an absence of relevant standard operating guidelines; lack of fire fighter team continuity; suboptimal incident command and risk management; and lack of a backup hose line.

NEAR MISS REPORTS

Report #10-213

After operating for about five hours at a large type III building, an officer on the scene determined it was necessary to enter the structure to search for a missing occupant. It was very cold and water had been flowing approximately 3000 GPM via two aerial master streams for about four hours.

Much of the water was frozen within the structure and the missing occupant was suspected of being in the room of origin. **It was evident to most on the scene that the victim, if inside, was dead.** Despite these facts, the IC allowed a company to enter the structure and go upstairs. **The axe they were using to sound the floor broke through the steps and fell into the basement. This easily could have been a Firefighter falling through the floor.**

Report #09-364

On the morning of [date and time deleted], we received an alarm of a structure fire about ½ mile from Station [1]. Engine [1], Engine [2] and Rescue [1] responded.

Upon the arrival of Engine [1] and Rescue [1] we found heavy smoke showing from the structure. Engine [1] laid two 1 ¾" lines and caught the hydrant right across the street. Engine [1] group went in through the front door, but due to extreme amount of heat, were not able to get to the seat of the fire. Group 1 lieutenant called for vertical ventilation but due to staffing issues, ventilation was not able to be performed.

Our chief arrived on scene and assumed command**. He advised us to exit the building and we were going defensive.** After exiting the house, group 1 pulled their line to the C-side of the structure and Group 2 (off of Engine [2]) pulled the second 1 ¾" to the B-side of the structure. The Incident Commander then advised the first arriving off duty personnel to set up the PPV fan at the front door. Once two off-duty personnel arrived, they became Group 3 and set up and turned on the fan. The structure was an old [deleted] house built in the early 1900s with a very big and open attic. **After the smoke cleared, the Incident Commander advised Group1 and 2 to stop flowing water because Group 3 was going in the front door and we were going back offensive.**

Due to heavy fire, Group 3 was doing no good and backed out. Two more off-duty personnel arrived **and the Incident Commander made them Group 4 and assigned them to vertically ventilate. This order was given 45 minutes into the fire and approximately 30 minutes after a defensive attack** was ordered and the PPV fan was set up. The **roof was already visibly sagging and from the road you could see heavy fire in the attic. Three lieutenants and a captain on scene advised the Incident Commander that the task was unsafe.** Group 4 ignored our plea and put a ladder on the building. Once on the roof and starting to ventilate, the roof gave way and collapsed. The two firefighters in Group 4 were standing on the roof ladder and were able to roll off the house. The roof ladder sustained major fire damage and the firefighter making the cuts was very lucky that his back up firefighter was holding onto him and saw the roof start to give way. This allowed for the backup firefighter to pull the [power saw operator] up and fall off the rood onto the ground instead of into the fire.

After it was over, the firefighters from Group 4 stated that the Incident Commander ordered us to ventilate and we were not going to break an order."

Report#09-926

A first due, four-person engine company arrived at an abandoned, single story wood-frame residential structure fire. **Approximately 60 percent of the building was involved, with the roof sagging on the "A / B" corner.** A firefighter, backed up by a captain, pulled a 2 ½" pre-connect with a combination nozzle and began attacking the fire from the "A" side. A permanent water supply had been established.

The crew was worried about an adjacent exposure structure approximately 30 feet away on the "B" side. Therefore, they attacked the fire head-on. The exposure structure was also an abandoned building.

The firefighter on the nozzle received second degree burns to shoulders, chest, thighs, and forearms (approximately 18% BSA). The burns were secondary to radiant heat. The firefighter was wearing full PPE, including an SCBA. His turnouts sustained some discoloration and melting on the reflective striping on arms, chest, and thigh area. The firefighter was transported to the hospital for burn care and released the next morning. He is off duty until further notice.

Report#09-532

The fire was in a two story, older commercial structure. The first floor housed a thrift store and an art gallery, with storage on the second floor. The fire started in the rear of the thrift store. **We found heavy fire coming out of the A, D, and C side doors and windows.** Crews went interior with a 2 1/2" line, entering on the D side, and operated about five minutes. Smoke caused the power lines to arc. The hose line was abandoned and the personnel were reassigned.
We were assigned to pull a 2 ½" line to the second floor from the outside stairs. The stairs were loose at the landing. **We attempted to force the door when the door frame fell into the building. The second floor flashed and the roof collapsed.** The incident commander changed to a defensive operation and abandoned the building. Approximately fifteen minutes later the fire breached into the art gallery. One firefighter sustained a minor injury.

Extend *LIMITED* Risk to Protect SAVABLE Property.

Objective: To cause the incident commander to limit risk exposure to a reasonable, cautious and conservative level when trying to save a building that is believed, following a size-up, to be savable.

LIMITED; the point, edge, or line beyond which something cannot or may not proceed. Confined or restricted within certain limits.

NO GO: If the building cannot be saved, consider an exterior defensive attack.

Narrative

Limited is defined as; *"the point, edge, or line beyond which something cannot or may not proceed, confined or restricted within certain limits".* In other words there is a limit, or line, beyond which firefighters may not be exposed to unsafe fire conditions. If a building can be saved, the incident commander should extend limited risk and carefully employ calculated operations which must be continuously monitored to ensure the safety line is not crossed.

The key word in this discussion is "savable". No fire attack or building is worth the life of a firefighter. If the building can be saved a cautious and conservative operation should be employed. The incident commander must also recognize they cannot always save a building. If conditions worsen and become unsafe during interior operations, crews must be withdrawn from the building in a timely fashion and defensive exterior operations employed. Most buildings that are lost will be rebuilt.

Much of our firefighting is conducted in buildings that are deemed savable. Some may refer to these as "bread and butter" or "routine" firefights. However, they do expose the firefighter to risks. Mishandled and they can, and have, killed firefighters.

Where the building is deemed savable attack hoselines must be of proper size and number to achieve fire control. There must be adequate staffing to conduct operations. All hoselines entering a burning building, or compartment, must be charged and operating with the correct pressures. In some cases it may be appropriate to use large caliber apparatus monitored monitor devices to quickly knock down fire before crews enter a building.

Recent research by Underwriters Laboratories determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

Interior firefighting operations must be fully supported with adequate resources on scene and risk must be closely and continually assessed. A fire that cannot be controlled quickly may be approaching flashover. The fire will also continue to eat away at the buildings structural integrity, weakening it, thus, increasing risk.

The incident commander should also be aware of the affects of wind on fire development and intensity. Any wind over 10 mph begins to have increasing dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increase risk to any firefighters downwind while in a building. The higher the wind speed the more intense the fire conditions. Once downwind windows fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building firefighters will be subject to a much greater blow torch affect than created by positive pressure ventilation.

The incident commander must consider the possibility of lightweight construction and early collapse potential. Underwriters Laboratory test determined some lightweight unprotected floor truss systems can collapse in 6.5 minutes after flame impingement – and without warning. This short time frame means collapse could occur as the first crews are entering the building.

Abandoned and dilapidated buildings are also a particular risk to firefighters and experience has shown there is very little likelihood that there are any occupants in the building. Should there be any active and growing fire in such a building which cannot be immediately controlled then a defensive strategy must be seriously considered at the outset.

Bottom line; No fire attack or building is worth the life of a firefighter. Risk must be closely and continuously assessed during interior operations. If the fire is about to harm firefighters, go defensive.

Teaching Points

- *No fire attack or building is worth the life of a firefighter. If the building can be saved, cautious and conservative operations should be applied.*

- *The incident commander and fire crews must recognize we cannot always save a building. When buildings are lost, most will be demolished and rebuilt. Limit risk as appropriate.*

- *Firefighting operations must be fully supported with adequate resources and risk must be closely and continually assessed. If conditions deteriorate and become unsafe, crews must be rapidly withdrawn before firefighters are harmed and defensive operations implemented.*

- *"Adequate resources" means an adequate numbers of firefighters to effectively engage and control the fire, the proper size and number of hoselines, and a secure (hydrant) water supply.*

- *Large caliber hose lines provide improved fire control and safety for firefighters where significant fire is encountered. In some cases it would be appropriate to use large caliber apparatus mounted monitor devices to quickly knock down fire before crews enter a building.*

- *Where hoselines are used for attack, they must be of proper size and number to achieve fire control. All hoselines entering or approaching a burning building or compartment must be charged and operating with the correct pressures.*

- *A fire that cannot be controlled quickly will continue to eat away at the buildings structural integrity, weakening it and increasing risk. An uncontrolled fire also continues to develop untenable fire conditions and lessens occupant survival.*

- *Where significant fire has consumed a building the buildings structural integrity must be assessed before fire crews re-enter the building.*

- *The risk to firefighters continues after fire control. All buildings will be structurally compromised to some degree by fire and a collapse potential may exist for crews conducting overhaul. The roof and floor trusses may be weakened substantially. The atmosphere will remain toxic for some time requiring continued SCBA use.*

- *Recent research by Underwriters Laboratories determined that a fire in a modern home* (contents of plastics and synthetics) *can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.*

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover,* ***the time from onset of untenability to flashover was less than 10 seconds!*** *This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *The incident commander must be aware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.*

- *The incident commander should also be aware of wind driven fires as they can almost instantly create an intense fire once a downwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

- *Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which efforts to save a building without conducting a risk exposure assessment led to fire fighter LODDs including:

Charleston, SC,- Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom – South Carolina;

http://www.cdc.gov/niosh/fire/reports/face200718.html

On June 18, 2007, nine career fire fighters (all males, ages 27 – 56) died when they became disoriented and ran out of air in rapidly deteriorating conditions inside a burning commercial furniture showroom and warehouse facility. **The first arriving engine company found a rapidly growing fire at the enclosed loading dock connecting the showroom to the warehouse**. The Assistant Chief entered the main showroom entrance at the front of the structure but did not find any signs of fire or smoke in the main showroom. He observed fire inside the structure when a door connecting the rear of the right showroom addition to the loading dock was opened. **Within minutes, the fire rapidly spread into and above the main showroom, the right showroom addition, and the warehouse**. The burning furniture quickly generated a huge amount of toxic and highly flammable gases along with soot and products of incomplete combustion that added to the fuel load. **The fire overwhelmed the interior attack and the interior crews became disoriented when thick black smoke filled the showrooms from ceiling to floor. The interior fire fighters realized they were in trouble and began to radio for assistance as the heat intensified.** One fire fighter activated the emergency button on his radio. The front showroom windows were knocked out and fire fighters, including a crew from a mutual-aid department, were sent inside to search for the missing fire fighters. Soon after, the flammable mixture of combustion by-products ignited, and fire raced through the main showroom. Interior fire fighters were caught in the rapid fire progression and nine fire fighters from the first-responding fire department died. At least nine other fire fighters, including two mutual-aid fire fighters, barely escaped serious injury.

Career Fire Fighter Dies in Wind Driven Residential Structure Fire – Virginia

http://www.cdc.gov/niosh/fire/pdfs/face200712.pdf

On April 16, 2007, a 24-year-old male career fire fighter was fatally injured while trapped in the master bedroom during a wind-driven residential structure fire. The victim was a fire fighter on the second apparatus to arrive on scene. **Fire was visible at the back exterior corner of the residence.** Noticing cars in the driveway, no one outside, and no lights visible in the house, the lieutenant from the first arriving engine called in a second alarm, suspecting the possibility of residents still inside. A charged 2 ½" hoseline was stretched to the front door by the first arriving engine crew but did not enter due to poor water pressure in the hoseline. The victim and his lieutenant, wearing their SCBA, entered the residence through the unlocked front door. **With light smoke showing, they walked up the stairs to check the bedrooms. The victim and lieutenant cleared the top of the stairs and went straight into the master bedroom. With smoke beginning to show at ceiling level,** the victim did a right-hand search while the lieutenant with thermal imaging camera (TIC) in-hand checked the bed. **Suddenly the room turned black then orange with flames.** The lieutenant yelled to the victim to get out. The lieutenant found the doorway and moved toward the stairs, falling down the stairs to midway landing. The lieutenant tried to direct the victim to the stairs verbally and with a flashlight**. As the wind gusted up to 48 miles per hour, the wind-driven fire and smoke engulfed the residence. The incident commander (IC) ordered an evacuation and the lieutenant was brought outside by the engine and rescue company crews.** Several attempts were made by the engine and rescue company crews to reach the second floor. On the third attempt the stair landing was reached but the ceiling started collapsing and flames intensified. Due to the intensity of the fire throughout the structure, all fire fighters were evacuated and operations turned defensive. The victim was found in the master bedroom partially on a couch underneath the front windows.

Volunteer Deputy Fire Chief Dies after Falling Through Floor Hole in Residential Structure during Fire Attack—Indiana.

http://www.cdc.gov/niosh/fire/reports/face200624.html

On June 25, 2006, a 34-year-old male volunteer Deputy Fire Chief **died after falling through a hole in the 1st floor of a residential structure during a basement fire attack. The floor system in the 2-year-old 3,200 ft^2 house contained engineered wooden I-Joists covered with plywood sheeting.** The basement was mostly unfinished and the I-Joists were exposed from the bottom. **Little smoke and no fire was visible when fire fighters initially entered the house but conditions rapidly deteriorated.** The victim was working by himself, operating a 1 ¾ inch hand line just inside the front entrance, when he fell into the basement. Attempts were made to reach the victim via a 14' roof ladder lowered into the hole, but debris in the basement, fire/smoke conditions, and the angle of the failed floor all disrupted attempts to reach the victim. Approximately 21 minutes elapsed from the time of the initial 911 call reporting the fire until the victim was located. The fire originated in the basement and the I-Joists were almost totally consumed in the area where the floor collapse occurred.

Career Engineer Dies and Fire Fighter Injured After Falling Through Floor While Conducting a Primary Search at a Residential Structure Fire – Wisconsin.

http://www.cdc.gov/niosh/fire/reports/face200626.html

On August 13, 2006 a 55-year-old male career Engineer (victim) died and his partner was injured after falling through the floor at a residential structure fire. ***The 5,600 ft^2 was constructed in*** *1999 and the first floor contained a heated* ***flooring system*** *consisting of a hot water piping system encased in lightweight concrete* ***which was supported by engineered wood I-Joists and trusses****. An* engine company was conducting a fast attack on a suspected basement fire, while a ladder company conducted horizontal ventilation. The victim and his partner were assigned to conduct a primary search on the ground floor. **Smoke made visibility difficult but little heat was detected as the victim and his partner proceeded to conduct a left hand search. They sounded the ceramic tile floor and took one crawling step while on their knees. They heard a large crack just before the floor gave way sending them into the fire burning in the unfinished basement.** The victim fell into the room of origin while his partner fell on the other side of a basement door into a hallway. The partner was able to eventually crawl out of a basement window. The victim was recovered the next day. The floor collapsed approximately 8 minutes after the first crews arrived on scene.

Volunteer Fire Fighter Dies After Falling Through Floor Supported by Engineered Wooden-I Beams at Residential Structure Fire – Tennessee.

http://www.cdc.gov/niosh/fire/reports/face200707.html

On January 26, 2007, a 24-year-old male volunteer fire fighter died at a residential structure fire after falling through **the ground floor that was supported by engineered wood I-beams. The victim's crew had advanced a hand line approximately 20 feet into the structure with near-zero visibility.** They requested ventilation and a thermal imaging camera (TIC) in an attempt to locate and extinguish the fire. The victim exited the structure to retrieve the TIC, and when he returned **the floor was spongy as conditions worsened which forced the crew to exit. The victim requested the nozzle and proceeded back into the structure within an arm's distance of one of his crew members who provided back up while he stood in the doorway. Without warning, the floor collapsed sending the victim into the basement**. Crews attempted to rescue the victim from the fully involved basement, but a subsequent collapse of the main floor ceased any rescue attempts. The victim was recovered later that morning.

Partial Roof Collapse in Commercial Structure Fire Claims the Lives of Two Career Fire Fighters – Tennessee.

http://www.cdc.gov/niosh/fire/reports/face200318.html

On June 15, 2003, a 39-year-old male career Lieutenant (Victim #1) and a 39-year-old male career fire fighter (Victim #2) died while trying to exit a commercial structure following a partial collapse of the roof which was supported by lightweight metal trusses (bar joists). The victims were part of the initial entry crew searching for the fire and possible entrapment of the store manager. **Both victims were in the back of the store operating a handline on the fire that was rolling overhead above a suspended ceiling. A truck company was pulling ceiling tiles searching for fire extension when a possible backdraft explosion occurred in the void space above the ceiling tiles. Victim #1 called for everyone to back out due to the intense heat, just as the roof system at the rear of the structure began to fail, sending debris down on top of the fire fighters.** Victim #1 and Victim #2 became separated from the other fire fighters and were unable to escape. Crews were able to remove Victim #2 within minutes and transported him to a local hospital where he succumbed to his injuries the following day. Soon after Victim #2 was removed, the rear of the building collapsed preventing further rescue efforts until the fire was brought under control. Victim #1 was recovered approximately 1 ½ hours later.

SPECIAL NOTE ABOUT LIGHTWEIGHT/ENGINEERED TRUSS SYSTEMS: Underwriters Laboratories, with funding from the Department of Homeland Security, has developed an on-line course for fire professionals – "Structural Stability of Engineered Lumber in Fire Conditions" available at their website *http://www.uluniversity.us./*

Houston, TX,- Career Fire Captain Dies When Trapped by Partial Roof Collapse in a Vacant House Fire – Texas;

http://www.cdc.gov/niosh/fire/pdfs/face200509.pdf

On February 19, 2005, a 39-year-old career fire Captain (the victim) **died after being trapped by the partial collapse of the roof of a vacant one-story wood frame dwelling. The house was abandoned and known by residents in the area to be a "crack house" at the time of the incident**. The victim was the captain on the first-arriving engine crew which was assigned to perform a "fast attack" – to take a hoseline into the house, locate the seat of the fire, and begin extinguishment. The one-story wooden ranch-style house was built in the 1950s and additional rooms had been added at the rear in at least two phases following the initial construction. Crews arriving on scene could see fire venting through the roof at the rear of the house. The victim and a fire fighter advanced the initial attack line through the front entrance and made their way toward the rear of the house**. Visibility was good in the front of the house but conditions quickly changed as they advanced toward the rear**. **The fast attack crew had just begun to direct water onto the burning ceiling in the kitchen and den areas when the roof at the rear of the structure (over the building additions) collapsed, trapping the captain under burning debris**. The collapse pushed fire toward the front of the house which quickly ignited carbon and dust particles suspended in the air along with combustible gases, sending a fireball rolling toward the front of the structure. Prior to the time of the collapse, two other crews had entered through the front entrance. The rapidly deteriorating conditions following the collapse quickly engulfed the other crews with fire. Crew members became disoriented and crews became separated as they attempted to find their way out. Five fire fighters received burns requiring medical attention.

NEAR MISS REPORTS

Report#08-522

Crews responded to a local cement manufacturing plant for a reported coal pile fire. When the crews arrived they discovered an exterior coal conveyor belt on fire. The conveyor is approximately 80-100 feet in height, covered, and was not operating at the time of the fire. The fire was attacked using elevated master streams from two ladder trucks. The main body of the fire was quickly knocked down. The incident commander and plant personnel put together a plan to overhaul the conveyor to extinguish the remaining pockets of fire that were burning in the accumulated coal dust. There were no visible flames at this time. The plan was to put hand lines in service along a cat walk located beside the conveyor. The process would be labor intensive as it was starting to get dark and the height of the conveyor slowed operations.

The plan was to start at one end of the conveyor and work towards the other end. Crews would be rotated out as they ran out of air. Lock-out/tag-out was confirmed. All crew were required to be in full PPE including SCBA. Hose streams and hand tools were used to break up the pockets of coal dust. The plan was in place and overhaul was started.

The winds had been gusty all day with gust to 25 mph. Approximately 2 -1/2 to 3 hours into the operation, the crew from Quint [1], working with a three person crew, was operating on the catwalk. No visible flames were present. **A strong gust of wind came up and created a coal dust cloud. The cloud ignited and completely enveloped one of the crew members in fire. The other two crew members were able to douse him with the hose stream in seconds.** The incident commander went on to say, " The fact that the crew was on air no doubt saved (the crewmember) from serious injury, or even death. Suffice to say all three were impressed with the explosive nature of the coal dust, and how quickly they were in trouble." The crew member remarked, "I felt as hot as sitting in the flashover simulator, only instantaneously." He was uninjured and continued working.

Extended Vigilant and Measured *Risk* to Protect and Rescue SAVABLE Lives.

Objective: To cause the incident commander to manage search and rescue, and supporting firefighting operations, in a highly calculated, controlled, and cautious manner, while remaining alert to changing conditions, during high risk search and rescue operations.

VIGILANT. On the alert; watchful.

MEASURED. Careful; restrained. Calculated; deliberate.

NO GO: If you don't have the resources to conduct safe search and rescue operations

Narrative

Firefighters, by the nature of their work, are routinely placed in a high risk environment. The highest risk levels are taken during search and rescue operations while other crews are attempting to control the fire.

The key words in this Rule are *vigilant* and *measured*. Vigilant is defined as "on the alert and watchful". During search and rescue operations the incident commander must remain alert to changing fire conditions that may increase risk or prevent rescue. Measured is defined as "careful, restrained, calculated and deliberate" - the applications of which must be seriously considered by the incident commander.

Being alert and watchful means the incident commander must continually assess fire conditions throughout the rescue event and is typically referred to as maintaining "situational awareness". Conditions will either be deteriorating or improving. It also means the incident commander must obtain progress reports of conditions from all points of the fireground. Worsening conditions observed from the exterior or elsewhere on the fireground can quickly increase the risk to firefighters involved in search operations.

Our goal as firefighters is to save lives and the fire service has a long history of aggressive search and rescue operations as an initial priority of first arriving fire companies. History (and firefighter fatalities) also reflects that firefighters are exposed to the greatest risk of injury and death during primary search and rescue operations. The incident commander's decision to search must be based on the potential to save lives. A safe and appropriate action plan cannot be accurately developed until we first determine if any occupants are trapped and can survive the fire conditions during the entire *rescue event* (the time to find AND then remove them). If survival is determine to be possible for the extraction period a search and rescue operation may be deemed appropriate.

Search and rescue and the removal of the victim takes time. Fire conditions are almost always deteriorating in the early stages, thus increasing risk and reducing occupant survival. The incident

commander must be constantly aware of changing conditions and balance the risks. Changing conditions may require the search to be terminated in the middle of the search and crews withdrawn.

Research conducted by the Phoenix and Seattle Fire Departments regarding search and rescue of downed firefighters determined that it took an average of 11-12 firefighters and an average of 19-21 minutes to complete the search and "extraction" of the firefighter from the building. While this research was for a downed firefighter in large buildings, it does reflect the realities of the time and resources needed to search, locate, and then remove the (civilian) victim from the building. And, it likely will take more than a two-firefighter team to complete.

Where it is believed lives can be saved, firefighters may tend to push the safety envelop. Risk may be justified, but must be closely monitored by the incident commander and controlled to a safe level. If fire conditions create too high of a risk, firefighters should be withdrawn to a safe location before they can be harmed. Search operations can resume following fire control.

Rescue operations must also be fully supported with adequate resources and risk must be continually assessed. "Adequate resources" means an adequate number of firefighters are on scene to effectively engage and control the fire, the proper size and number of hoselines used, and a secure (hydrant) water supply is established. If resources are inadequate to maintain firefighter safety during search and firefighting operations, other safer approaches should be considered or defensive operations implemented.

Large caliber hose lines provide improved fire control and safety for firefighters. In some cases it would be appropriate to use large caliber apparatus mounted monitor devices to quickly knock down fire before crews enter a building to conduct search and rescue operations.

Where hoselines are used for attack, they must be of proper size and number, with adequate staffing, to protect the search effort and achieve fire control. All hoselines must be charged and operating with the correct pressures before entering the fire compartment.

The incident commander must be vigilant and on alert for changing conditions. Recent research by Underwriters Laboratories determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

Where conditions begin to deteriorate, firefighters must be withdrawn to a safe location before the fire can harm them.

The incident commander should also be aware of the affects of wind on fire development and intensity. Any wind over 10 mph begins to have increasingly dangerous affects by dramatically increasing the

intensity of fire conditions in a building and rapidly increasing risk to any firefighters downwind while in a building. The higher the wind speed the more intense the fire conditions. Once downwind windows fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building firefighters will be subject to a much greater blow torch affect than created by positive pressure ventilation

The incident commander must consider the possibility of lightweight construction and early collapse potential. Underwriters Laboratory test determined some lightweight unprotected truss can collapse in 6.5 minutes after flame impingement – and without warning. In some situations, collapse could occur as arriving firefighters are starting operations.

Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.

Bottom line; During search efforts, the incident commander must maintain situational awareness of changing fire conditions, and what's happening elsewhere on the fireground to ensure safe search operations.

Teaching Points

- *Firefighters, by the nature of their work, are the persons experiencing the highest risk exposure during offensive, interior, operation. The risk is increased during search and rescue operations.*

- *Our goal is to save lives. Where the survival profile indicates lives may be saved, risk may be justified – BUT, search and rescue operations should be in applied in a very calculated manner <u>while being alert and watchful for changing conditions that may put firefighters at risk.</u>*

- *The occupant survival profile assessment plays an important role in the tactical decision to commit to search and rescue operations<u>. It must be recognized it takes time to conduct a search and complete (extract) a rescue.</u> What appears to be a reasonable risk*

when the decision is made can rapidly deteriorate with time and place firefighters at extreme risk.

- *Where it is believed lives can be saved, firefighters may tend to push the safety envelop. The risk may be justified, but must be closely monitored and controlled in a safe manner. If deteriorating conditions present too high of risk, search and rescue operations should be terminated and firefighters should be withdraw.*

- *Rescue operations must be fully supported with adequate resources and risk must be closely and continually assessed. "Adequate resources" include the required number and size of attack hoselines, a secure water supply, AND adequate numbers of firefighters.*

- *If resources are inadequate to maintain firefighter safety during search and firefighting operations, consider other safe approaches or implement defensive operations.*

- *The incident commander and command organization offices must remain alert for changing conditions and balance the risks in a measured manner. Changing conditions may require the search to be terminated in the middle of the search.*

- *The incident commander must be vigilant and on alert for changing conditions. Recent research by Underwriters Laboratories determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.*

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover,* ***the time from onset of untenability to flashover was less than 10 seconds!*** *This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *Once crews are committed, and conditions deteriorate, it will take time to withdrawal crews. The incident commander must stay ahead of the fire and evacuate firefighters in time and before the fire can harm them.*

- *Large caliber hose lines provide improve fire control and safety for firefighters. In some cases it may be appropriate to use large caliber apparatus mounted monitor devices to quickly knock down fire before crews enter a building to conduct search and rescue operations.*

- *Where hoselines are used for attack, they must be of proper size and number to achieve fire control. All hoselines entering or approaching a burning building or compartment must be charged and operating with the correct pressures.*

- *<u>Search and rescue and the removal of the victim takes time and resources.</u> Fire conditions are almost always deteriorating in the early stages of the search, thus increasing risk. Firefighters must be constantly aware of changing conditions and balance the risks. Changing conditions may require the search to be terminated in the middle of the search.*

- *Research conducted by the Phoenix and Seattle fire departments in buildings of approximately 5,000 square feet determined that an average of 11–12 members were required to rescue a downed firefighter. Additionally, it took an average of 19-21 minutes to complete a rescue and extract the victim.*

- *This research was conducted under a "sterile' conditions. Search and rescue during an active fire with heat, smoke, debris, and wet floor and slippery conditions search and rescue can be expected to take longer.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a downwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

- *Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.*

- *Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.*

- *Don't Push the Safety Envelop and put firefighters at unaccepted/unwarranted risk.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in the incident commander did not manage the operation in a vigilant and measured manner with a calculated, controlled and cautious approach which became a contributing factor to fire fighter LODDs including:

Career Fire Fighter Dies and Captain is Injured During a Civilian Rescue Attempt at a Residential Structure Fire – Georgia

http://www.cdc.gov/niosh/fire/reports/face200716.html

On May 28, 2007, a 41-year-old male career fire fighter (the victim) **died after becoming disoriented and falling down a set of stairs while searching for a missing male occupant at a residential structure fire.** A fire captain also received second degree burns resulting in lost-time from work. Both the victim and the captain were members of the first-responding fast attack engine company. After becoming disoriented, they were trapped and missing for several minutes before being found. The fire was reported at approximately 0449 hours. The first arriving fire fighters, including the victim, arrived on the scene at 0459 hours and were on-scene 13 minutes when the first mayday was called. **The male resident also perished in the fire.**

A Career Captain and an Engineer Die While Conducting a Primary Search at a Residential Structure Fire - California

http://www.cdc.gov/niosh/fire/reports/face200728.html

On July 21, 2007, a 34-year-old career captain and a 37-year-old engineer (riding in the fire fighter position) died while conducting a primary search for two trapped civilians at a residential structure fire. The two victims were members of the first arriving crew. They made a fast attack and quickly knocked down the visible fire in the living room. **They requested vertical ventilation, grabbed a thermal imaging camera, and made re-entry without a handline to search for the two residents known to be inside.** Another crew entered without a handline and began a search for the two residents in the kitchen area. A positive pressure ventilation fan was set at the front door to increase visibility for the search teams. **The second crew found and was removing one of the civilian victims from the kitchen area as rollover was observed extending from the hallway into the living room.** Fire fighters became concerned for the air supply of both victims who were still in the structure. Crews conducted a search for the victims and found them in a back bedroom where they had been overcome by the rapid fire event.

Volunteer Fire Fighter and Trapped Resident Die and a Volunteer Lieutenant is Injured following a Duplex Fire - Pennsylvania

http://www.cdc.gov/niosh/fire/pdfs/face200806.pdf

On February 29, 2008, a 21-year old male volunteer fire fighter (the victim) and a 33-year old volunteer Lieutenant were injured during a structural fire. **The fire fighters were attempting to locate and rescue a 44-year old female resident from a burning duplex. The fire fighters became trapped on the second floor when fire conditions deteriorated.** The victim was rescued by the rapid intervention team (RIT) and both the victim and injured Lieutenant were transported to the hospital. The victim remained in critical condition for several days in the burn unit before succumbing to his injuries on March 5, 2008. The female resident of the structure did not survive the fire.

Residential House Fire Claims the Life of One Career Fire Fighter–Florida

cdc.gov/niosh/fire/reports/face20004.html

On November 25, 2000, a 30-year-old career male fire fighter (the victim) died in a residential house fire. At 0135 hours, fire fighters received a call of a reported structure fire. Engines 5, 2, 1, Ladder 11, and Rescue 32 responded to the early morning call. At 0141 hours, Engine 5 arrived on the scene and the Captain assumed incident command (IC). **The IC reported to dispatch that they had a <u>well-involved, single-story house fire</u>. He then decided to send a search team inside the structure because it was *unclear if the homeowners had exited*.** The victim from Engine 5, and the Captain and the Lieutenant from Rescue 32, teamed up to enter the house and complete the search. The victim, Captain, and Lieutenant advanced a 1¾-inch handline through the front door as the Captain and Lieutenant from Ladder 11 were ordered to set up positive pressure ventilation (PPV) fan at the front door and then back up the search crew. The Lieutenant and a fire fighter from Engine 1 advanced a second line to the rear of the structure to attack the fire. The victim, and the Captain and Lieutenant from Rescue 32, advanced their line down a hallway and into a bedroom when **the Captain noticed heavy fire in a room off to their right.** The Captain requested that the victim pass him the nozzle because there was heavy fire in an adjacent room in the rear of the structure and he was afraid it was going to flash. The Lieutenant responded, saying that they could not locate the nozzle. **In fear of a possible flashover, the Captain ordered the victim and Lieutenant to exit immediately. As the three attempted to exit, the hallway became heavily involved with fire. The Lieutenant and Captain fell over debris and the victim became disoriented. The Captain and Lieutenant exited the structure but the victim did not exit.** The IC immediately ordered exterior crews to enter the structure and search for the missing victim. Approximately 56 minutes later, fire fighters found the victim. He was pronounced dead at the scene.

<u>NEAR MISS REPORTS</u>

MORE REPORTS PENDING

Act Upon Reported Unsafe Practices and Conditions That Can Harm Firefighters. Stop, Evaluate and Decide.

Objective: To prevent firefighters and supervisors from engaging in unsafe practices or exposure to unsafe conditions that can harm them and *allowing any member to raise an alert about a safety concern without penalty* and mandating the incident commander and command organization officers promptly address the question to insure safe operations.

NO GO: Do not let anything happen that will harm a firefighter.

Narrative

The incident commander is ultimately responsible for firefighter safety. The nature of firefighting routinely places the company officer and crew members in areas of greatest risk. As a result they are often in a position to detect unsafe conditions and practices before the incident commander will. The incident command team must allow a means to report these situations in a structured, proper process, before firefighters are harmed. This Rule accomplishes that;

Because firefighting posses significant risk to firefighters the incident commander (and the command organization) must minimize or eliminate their exposure to unsafe conditions and stop unsafe practices. NIOSH firefighter fatality reports routinely describe incidents where unsafe conditions or practices existed which were either not reported or ignored and later were listed as contributing factors in the line of duty death.

The fire service has always been a para-military organization when it comes to fireground operations. In most cases, the incident commander makes a decision, sends the order down to through supervisors to the company officer and crew. Fire crews have generally viewed these orders as top down direction. There is often little two-way discussion about options. Where this culture exists, crews have been trained to accept the order and do it – generally without question. This situation makes it very uncomfortable for firefighters to say no to unsafe conditions or practices. Additionally, the fire service has not clearly defined how a firefighter, supervisors, or the incident commander should process a safety concern identified by a firefighter.

The aviation industry experienced a similar problem of one way decision making and communication. The old culture placed the captain in charge of all aircraft operations. The culture didn't tolerate a challenge from crew members. As a result, post crash investigations found captains occasionally flew their planes into the ground, even as other crew members, including the co-pilot, knew something was wrong, and often tried to tell the pilot – only to be rejected.

The commercial airline industry fixed their problem through a new management system called "cockpit crew resource management". This new system required the captain to listen to crew input regarding safety, and authorized the crew to participate in decision making. They became a team looking out for their own welfare as well as their passengers. The program resulted in a rather dramatic reduction in accidents caused by pilot errors.

The International Association of Fire Chief has adopted “Crew Resource Management” as a tool for fire departments to use.

This Rule applies the principles of crew resource management by encouraging all firefighters to apply situational awareness and be responsible for their own safety and that of other firefighters. It authorizes each member to identify, report and correct unsafe conditions and practices. In a sense all firefighters become the additional eyes and ears for the incident commander and alerting him (or their immediate supervisor) of unsafe situations. No fire attack or building is worth the life of a firefighter or a preventable (sometimes career ending) injury. The intent of this Rule is to allow any member to report a safety concern through a structured process without fear of penalty.

The incident commander should know that the “Rules of Engagement for Firefighter Survival” states the firefighter is “required” to report unsafe conditions and practices.

This Rule by no means suggests that a firefighter is authorized to engage in insubordination. The fireground is fast paced action and clearly must be managed by a well disciplined and structured command organization. *This Rule does, however, allow a “red flag” to be raised about a safety issue by any member.* When the red flag is raised, *the supervisor is mandated to accept that concern*, take a few seconds to stop (assess), talk, and make a safe decision (go, no-go). In some cases, the situation may affect other areas of the fireground, or the action plan, and must be communicated to the incident commander or other supervising officers.

The incident commander is ultimately responsible for safety on the fireground. As such, he must act upon these reports and insure the command team does likewise.

Much of the application of this Rule must occur before the fire incident in training sessions and by developing SOP’s related to this Rule. All firefighters need to know they are authorized to both report and say no to unsafe conditions and practices. Further, supervisors must clearly understand their responsibility of accepting and immediately acting upon (appropriately) any reported safety concerns by firefighters.

Recent research by Underwriters Laboratory’s determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today’s typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

The incident commander should also be aware of the affects of wind on fire development and intensity. Any wind over 10 mph begins to have increasing dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increase risk to any firefighters downwind while in a building. The higher the wind speed the more intense the fire conditions. Once downwind windows fail

or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building firefighters will be subject to a much greater blow torch affect than created by positive pressure ventilation.

Bottom line: If any report from a firefighter indicates an unsafe condition or practice, fix it!

Teaching Points

- *The prime responsibility of all incident commanders is to ensure safe operations.*
- *The firefighter is nearly always to point person working in the area of greatest risk.*
- *No fire attack or building is worth the life of a firefighter.*
- *All firefighters are responsible for their own safety and the safety of other firefighters working with them. All command team officers are responsible for their own safety and the firefighters working for them. Each of these groups is responsible for identifying risks and hazards and reporting them. The incident commander must insure supervisors accept reports without hesitation and promptly acts on them to ensure the safety of firefighters.*
- *The incident commander and all command team officers, are mandated to accept any report regarding unsafe conditions or practices and take appropriate and safe action to make the situation safer.*
- *All firefighters within the hazard zone are at the point of greatest risk. Their position allows them to identify unsafe conditions that the incident commander, or the division or group supervisor, may not see. They must be authorized to report the situation and take safe corrective action to make operations safer.*
- *This Rule by no means suggests that a firefighter engage in insubordination. The fireground is fast paced action and clearly must be managed by a well disciplined and structured command organization. This policy statement does, however, allow any firefighter to raise a "red flag" safety concern without penalty.*

- *When the situation is questioned, the supervisor is mandated to accept that safety concern, take a few seconds to stop (assess), talk, and make a safe decision (go, no-go, or modify the objective/task). In some cases, the situation may affect the incident commander's action plan or other areas of the fireground and must be reported to the incident commander or other supervising officers. The policy has proven to be successful in reducing risk to firefighters.*

- *In some cases, the unsafe situation may affect other areas of the fireground and must be communicated to the incident commander or other supervising officers.*

- *Any report on an unsafe condition or practice, or corrective action, which will affect the action plan, must be reported to the incident commander.*

- *Recent research by Underwriters Laboratory's determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.*

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover,* ***the time from onset of untenability to flashover was less than 10 seconds!*** *This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a downwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which fire fighters or supervisors had the opportunity to report unsafe practices or exposures to unsafe conditions and didn't, including:

Charleston, SC,- Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom – South Carolina;

http://www.cdc.gov/niosh/fire/reports/face200718.html

On June 18, 2007, nine career fire fighters (all males, ages 27 – 56) died when they became disoriented and ran out of air in rapidly deteriorating conditions inside a burning commercial furniture showroom and warehouse facility. **The first arriving engine company found a rapidly growing fire at the enclosed loading dock connecting the showroom to the warehouse.** The Assistant Chief entered the main showroom entrance at the front of the structure but did not find any signs of fire or smoke in the main showroom. He observed fire inside the structure when a door connecting the rear of the right showroom addition to the loading dock was opened. Within minutes, the fire rapidly spread into and above the main showroom, the right showroom addition, and the warehouse. The burning furniture quickly generated a huge amount of toxic and highly flammable gases along with soot and products of incomplete combustion that added to the fuel load. The fire overwhelmed the interior attack and the interior crews became disoriented when thick black smoke filled the showrooms from ceiling to floor. **The interior fire fighters realized they were in trouble and began to radio for assistance as the heat intensified.** One fire fighter activated the emergency button on his radio. The front showroom windows were knocked out and fire fighters, including a crew from a mutual-aid department, were sent inside to search for the missing fire fighters. Soon after, the flammable mixture of combustion by-products ignited, and fire raced through the main showroom. Interior fire fighters were caught in the rapid fire progression and nine fire fighters from the first-responding fire department died. At least nine other fire fighters, including two mutual-aid fire fighters, barely escaped serious injury.

Throughout this incident, leading up to flashover, there were numerous observable or described unsafe conditions and practices. Unsafe practices included lack of implementation of the incident command system, using undersized fire attack lines (including a booster line) for fire conditions/magnitude of fire, attacking the fire on the interior with tank water and no hydrant supply, inadequate sized hose (2.5 inch) supply lines, no consistent buddy teams, lack of ventilation, etc.

Residential House Fire Claims the Life of One Career Fire Fighter–Florida

cdc.gov/niosh/fire/reports/face20004.html

On November 25, 2000, a 30-year-old career male fire fighter (the victim) died in a residential house fire. At 0135 hours, fire fighters received a call of a reported structure fire. Engines 5, 2, 1, Ladder 11, and Rescue 32 responded to the early morning call. At 0141 hours, Engine 5 arrived on the scene and the Captain assumed incident command (IC). **The IC reported to dispatch that they had a <u>well-involved, single-story house fire</u>. He then decided to send a search team inside the structure because it was *unclear if the homeowners had exited*.** The victim from Engine 5, and the Captain and the Lieutenant from Rescue 32, teamed up to enter the house and complete the search. The victim, Captain, and Lieutenant advanced a 1¾-inch handline through the front door as the Captain and Lieutenant from Ladder 11 were ordered to set up positive pressure ventilation (PPV) fan at the front door and then back up the search crew. The Lieutenant and a fire fighter from Engine 1 advanced a second line to the rear of the structure to attack the fire. The victim, and the Captain and Lieutenant from Rescue 32, advanced their line down a hallway and into a bedroom when **the Captain noticed heavy fire in a room off to their right.** The Captain requested that the victim pass him the nozzle because there was heavy fire in an adjacent room in the rear of the structure and he was afraid it was going to flash. The Lieutenant responded, saying that they could not locate the nozzle. **In fear of a possible flashover, the Captain**

ordered the victim and Lieutenant to exit immediately. As the three attempted to exit, the hallway became heavily involved with fire. The Lieutenant and Captain fell over debris and the victim became disoriented. The Captain and Lieutenant exited the structure but the victim did not exit. The IC immediately ordered exterior crews to enter the structure and search for the missing victim. Approximately 56 minutes later, fire fighters found the victim. He was pronounced dead at the scene.

NEAR MISS REPORTS

Report #07-795

While on the scene of a multiple occupancy, single story, commercial structure fire, our incident command requested mutual aid companies from several other departments. We had fire blowing through the front windows and door. After the majority of the fire was knocked down, a mutual aid company was assigned the task of opening up the metal roof. It was at this point and time when things got a little scary. One of the mutual aid companies laddered the roof and ascended with three firefighters and a lieutenant. **One of the firefighters was carrying an axe in his left hand, a saw in his right hand, and trying to climb the ladder at the same time. There were several other firefighters under and around the area as this was taking place. There were numerous rope bags on hand to hoist tools instead of carrying this tool combination. This same company was also observed by me and many other firefighters and officers dropping tools off the roof, being too close to each other on the roof while swinging an axe, and really just posing a huge safety risk to everyone on the fireground.** This all happened with our Safety Officer sitting on the bumper of our engine. There were numerous chiefs and other officers watching these unsafe acts. None of them said anything to this company.

Report#06-181

On the morning of 24DEC04 at 0100, our department responded to a rekindled structure fire in a 3 story balloon construction. The first fire was heavily involved on the previous day, same shift. **The department attempted an interior attack. After some time, the structure was deemed unsafe and the department went to a defensive posture**. Approximately 20 minutes later, **the OIC created a "task force" of 3 firefighters from our department and 3 from a mutual aid department to attempt an interior attack on the 3rd floor**. There were no accountability tags from the other department.

When we started walking into the house, I stated that I had "a bad feeling" about the situation and was wary of going back into a home that was deemed unsafe a half an hour ago. As we made our way into the third floor, our department split from the mutual aid department. We all remained on the 3rd floor but in separate rooms. Another firefighter and I crawled into an attic space to hit the fire while our 3rd member stayed in the room to feed hose around a knee wall to our position. Inside the attic/crawl space, **after approximately 2 minutes, we heard a large crash. We reversed our direction and once in the room, we noticed the roof had collapsed.** All we could see was stars and the full moon. **Our 3rd firefighter was nowhere to be found. He was buried in the collapsed roof made of very heavy slate tiles.** RIT was activated and our member was removed safely by RIT with little entanglement or extrication. Now the two of us were trapped as the rubble had blocked the stairs, our egress. We were

assisted through a hole in the rubble to the stairs below the pile after 5 minutes of moving debris. The mutual aid department was the removed. No injuries no deaths. However, the firefighter that had the roof fall on him stated he felt the roof hit his head and push him down. He stated had his head been turned in either direction even by a slight amount, he would have a broken neck or been killed.

Report#09-522

My lieutenant and I made entry into a one-story home of a reported basement fire. We utilized a left hand search as a tactic to locate the basement. For an attack line, we pulled a charged, 200 foot, pre-connect. After making it to the bottom of the stairs, we heard the fire in the direction of the A/B corner which was the corner we had entered the building on the ground floor. There was an insufficient amount of hose to make a direct attack on the fire at this time. My lieutenant attempted to notify command to get us more hose, but was unable to transmit due to increased radio traffic**. The fire in the basement was indicating an impending flashover, and we realized it was time to get out.** We immediately began to retreat from the basement along with the back-up crew. **After ascending the stairs,** we headed towards the A/B corner of the ground floor to exit the building. **I was following my lieutenant and we noticed the floor felt incredibly spongy. As I pushed off with my right leg, I fell through the floor up to my groin. I was able to remove my leg but was met with fire, pushing from the hole that my foot had just made.** I sprayed water from our attack line for about 5 seconds to try to knock the fire down and give the back-up crew a few more seconds to get over the weakened floor and out of the house. Unfortunately, the water had no effect on the fire as it was well into the free-burning stage. The back-up crew was cut-off and had to look for a secondary egress point. **After I exited the building, I immediately notified command that the floor was compromised. Command cleared all units from the interior and we began a defensive attack on the building.** The back-up crew exited the building through a plate glass window on the A-side of the building, one of the members received a cut to the hand.

Report #09-298

After a recent third alarm was brought under control, a ladder company firefighter (who was performing overhaul) stepped out of a third floor window onto a wooden balcony which immediately collapsed. The balcony and where it was attached to the building had been weakened by fire. The third floor collapsed onto the second floor causing that balcony to collapse and sending the member violently to the ground.

The condition of the rear wall and balcony were well known throughout the operation. There were numerous radio messages warning of this condition. The breakdown in communications occurred when a relieving unit was not notified of these dangers. The situation could have been a tragedy. Incredibly, the member only suffered minor injuries.

Case Report - Seattle Fire Department

On the night of January 5, 1995, four Seattle firefighters died when the first floor of a commercial warehouse collapsed.

In 2001 a Seattle ladder company officer and a probationary firefighter became lost on the third floor of an apartment building during a multiple alarm fire. As they were trying to find their way out, the officer ran out of air and became separated from the firefighter. The firefighter was able to find and exit. The officer, now sucking smoke, found a window a dropped three stories and received severe injuries but survived.

In July, 2001, a new fire chief was appointed. Within two months, two additional near fatal incidents occurred. One firefighter became separated from his partner in the hold of a multiple ship fire and ran out of air. By chance, another crew found the firefighter and the crew exited with the firefighter.

A month later, a captain at a working residential fire experienced a mechanical failure on his SCBA and collapsed from smoke inhalation. Another crew found the unconscious fire officer and rescued him. He was intubated and transported to the hospital where he fully recovered.

The fire chief called a “Safety Stand Down” and had staff rapidly develop a Firefighter Survival Training Program. The fourth quarter scheduled training was dropped and replaced with the survival training. Included was multi-bullet a new “Best Safety Practices” policy. One of the bullets stated;

- Any Member is Authorized to Say NO to Unsafe Practices or Conditions. Stop, Talk, and Decide.

During training, a survivor of the 1995 fire described arriving as a second due engine company with heavy smoke issuing from the building. His crew stretched a hoseline to the front door to back up the first crew that had entered earlier. As he was putting on his face piece he noted smoke pushing out of cracks in the sidewalk and thought that was awfully odd. The culture at the time (like many fire departments) made it awkward for any firefighter to challenge a company officer on a decision. The crew entered the building and moments later the floor fell away from them.

He told the training officer that had the new policy with the above bullet been in place that night in 1995 he would have been far more comfortable to raise an alert and perhaps all the firefighters would have been saved.

Maintain Frequent Two-Way Communications and Keep Interior Crews Informed of Changing Conditions

Objective: To insure that the incident commander is obtaining frequent progress reports and all interior crews are kept informed of changing fire conditions observed from the exterior by the incident commander, or other command officers, that may affect crew safety.

Narrative

Radio communications on the fireground plays a critical role in both firefighter safety and keeping the action plan current.

The general practice, when using the incident command system, the incident commander typically obtains progress reports from crews or supervisors operating on the interior of the building or exterior locations. It may not be common practice for the incident commander to routinely provide a progress report to interior crews about fire conditions observed from the exterior, or share critical information obtained from elsewhere on the fireground, that may affect their safety. But he must.

The sharing of critical information is particularly important to interior crews and addresses the key principles of "crew resource management". In order for interior crews to maintain full situational awareness the incident commander MUST keep these crews informed of changing conditions and any critical exterior observations that may affect their safety. What is observed on the exterior, or what is occurring elsewhere on the fireground, may quickly increase the risk and reduce the safety of firefighters.

Interior crews have often reported moderate conditions at their location on the interior (i.e. below an attic fire) while the incident commander (or division or group supervisors) on the exterior are observing deteriorating fire conditions coming from the attic space. Crews on the interior need to know what's being observed on the exterior. Communicate!

It's also absolutely essential that the incident commander, and command organization officers, constantly monitor (listen) to all radio communications (from crews within the hazard zone) for critical radio reports or potential May Days declarations. It's also essential that all crew members closely monitor ongoing radio reports on their assigned tactical channel for critical reports or communication to them from the incident commander.

Bottom line: If you can't keep interior crews regularly informed of changing conditions don't commit to interior operations.

Teaching Points

NO GO:

- *It's absolutely critical that the incident commander, and command organization officers, constantly monitor all communications. To improve safety, it's especially important the incident commander be located at a stationary command post and in a command vehicle for its quieter environment.*

- *The general practice, when using the incident command system, is for the incident commander to obtain progress reports from supervisors or crews operating on the interior of the building. It is not common practice for the incident commander to provide a progress reports to interior crews about exterior observations of fire conditions that may affect their safety. But he must.*

- *Frequent two-way communications means the incident commanders provides interior crews progress reports regarding exterior observations or critical information that may affect their safety. It also means company officers, and other command organization officers, also provide the incident commander with frequent progress reports.*

- *In order to maintain crew situational awareness, the incident commander MUST keep interior crews informed of changing conditions and exterior observations. What is observed on the exterior, or what is occurring elsewhere on the fireground, may quickly increase the risk and reduce the safety of firefighters.*

- *Interior crews have often reported moderate conditions at their location on the interior while the incident commander (or division or group supervisors) is observing deteriorating fire conditions from the exterior. This information must be shared with interior crews.*

- *It's absolutely essential that the incident commander and command organization officers constantly monitor (listen) all radio communications (from crews within the hazard zone) for critical radio reports or May Days.*

- *Crews on the interior need to know what's being observed on the exterior. Communicate*!

The NIOSH Fire Fighter Fatality Investigation and Prevention program has identified a number of incidents in which the incident commander and company officers/fire fighters and supervisors did not maintain frequent two-way radio communications to report changing conditions, including:

Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom – South Carolina;

http://www.cdc.gov/niosh/fire/reports/face200718.html

On June 18, 2007, nine career fire fighters (all males, ages 27 – 56) died when they became disoriented and ran out of air in rapidly deteriorating conditions inside a burning commercial furniture showroom and warehouse facility. **The first arriving engine company found a rapidly growing fire at the enclosed loading dock connecting the showroom to the warehouse.** The Assistant Chief entered the main showroom entrance at the front of the structure but did not find any signs of fire or smoke in the main showroom. He observed fire inside the structure when a door connecting the rear of the right showroom addition to the loading dock was opened. **Within minutes, the fire rapidly spread into and above the main showroom, the right showroom addition, and the warehouse. The burning furniture quickly generated a huge amount of toxic and highly flammable gases along with soot and products of incomplete combustion that added to the fuel load. The fire overwhelmed the interior attack and the interior crews became disoriented when thick black smoke filled the showrooms from ceiling to floor. The interior fire fighters realized they were in trouble and began to radio for assistance as the heat intensified.** One fire fighter activated the emergency button on his radio. The front showroom windows were knocked out and fire fighters, including a crew from a mutual-aid department, were sent inside to search for the missing fire fighters. Soon after, the flammable mixture of combustion by-products ignited, and fire raced through the main showroom. **Interior fire fighters were caught in the rapid fire progression and nine fire fighters from the first-responding fire department died**. At least nine other fire fighters, including two mutual-aid fire fighters, barely escaped serious injury.

One Career Firefighter/Paramedic Dies and Part-time Firefighter is Injured When Caught in Residential Structure

NIOSH Case number F2010-10

Executive Summary

On March 30, 2010, a 28-year-old male career fire fighter/paramedic (victim) died and a 21-year-old female part-time fire fighter/paramedic was injured when caught in an apparent flashover while operating a hoseline within a residence. Units arrived on scene to find heavy fire conditions at the rear of a house and moderate smoke conditions within the uninvolved areas of the house. A search and rescue crew had made entry into the house to search for a civilian who was entrapped at the rear of the house. The victim, the injured fire fighter/paramedic, and a third fire fighter made entry into the home with a charged 2 ½ inch hoseline. Thick, black rolling smoke banked down to knee level after the hoseline was advanced 12 feet into the kitchen area. While ventilation activities were occurring, the search and rescue crew observed fire rolling across the ceiling within the smoke. They immediately yelled to the hoseline crew to “get out.” The search and rescue crew were able to exit the structure safely, then returned to rescue the injured fire fighter/paramedic first and then the victim. The victim was found wrapped in the 2 ½ inch hoseline that had ruptured and without his facepiece on. He was quickly brought out of the structure, received medical care on scene, and was transported to a local hospital where he was pronounced dead.

The firefighter victim was found to have his portable radio tucked in his rear pocket of his station uniform pants and under his bunker pants. It would have been impossible for him to hear radio communications and he could not have declared a May Day.

NIOSH Case number 2009-11

Shortly after midnight on Sunday, April 12, 2009, a 30-year old male career probationary fire fighter and a 50-year old male career captain were killed when they were trapped by rapid fire progression in a wind-driven residential structure fire. The victims were members of the first arriving company and initiated fast attack offensive interior operations through the front entrance. Less than six minutes after arriving on-scene, the victims became disoriented as high winds pushed the rapidly growing fire through the den and living room areas where interior crews were operating. Seven other fire fighters were driven from the structure but the two victims were unable to escape. Rescue operations were immediately initiated but had to be suspended as conditions deteriorated. The victims were located and removed from the structure approximately 40 minutes after they arrived on location.

Key contributing factors identified in this investigation include: an inadequate size-up prior to committing to tactical operations; lack of understanding of fire behavior and fire dynamics; fire in a void space burning in a ventilation controlled regime; high winds; uncoordinated tactical operations, in particular fire control and tactical ventilation; failure to protect the means of egress with a backup hose line; inadequate fireground communications; and failure to react appropriately to deteriorating conditions.

The captain victim dismantled his apparatus without his portable radio. Thus, he was operating blind and without the ability to be aware of radio communications (in deteriorating conditions) and without the ability to provide the incident commander any progress reports. Nor could he have declared a May Day

His partner and victim number 2, a probationary firefighter, was found to have his portable radio in the bunker coat pocket – but, it was turned off and on the wrong channel. He also was operating blind to any radio communications or reports of fire conditions (or evacuation orders).

Report#09-990

Our department was dispatched to a structure fire reported by police who were initially dispatched to a burglar alarm. First companies arrived to find **a two story, wood frame multi-use structure with moderate smoke issuing from the structure.** After forcing entry, the engine company (three person hose team) entered with an inch and three-quarter attack line and a TIC. **The crew reported high heat conditions and indicated that the TIC screen was red!** They proceeded to the right and pushed to the rear of the structure with heavy black smoke but no visible fire. A rescue company (2 person team) entered shortly after the engine company. They too reported extreme heat at the floor and a Red screen on the TIC. The rescue crew also proceeded to the right and pushed to the rear.

<u>Outside, the IC and ladder company crew observed smoke conditions rapidly changing</u> from laminar light brown smoke to a turbulent black smoke pushing from the entry doorway. At this time, IC attempted to contact the initial engine company without success.

Back inside, the rescue crew reached the engine company at the rear wall. They all reported the same high heat conditions with no visible fire. Some confusion occurred when personnel mingled together and at some point, the rescue crew lost contact with each other. The engine captain also lost track of one of his two rookie firefighters. One of the rescue members retreated outside and reported he had lost his partner. At the same time, the engine captain attempted to radio IC that he too had lost a member of his crew and to report the condition encountered inside.

Back outside, the IC ordered the ladder company to "vent" a large window on the A Side of the structure. As this window was vented, the ladder crew observed fire at the floor level and it rolled across the room toward the rear of the structure.

The captain of the engine observed the fire roll over head and ordered his crew to evacuate. He reported extreme heat and made a hasty exit out of a window. Upon exiting, he reported that he had lost his crew and a MAYDAY was called. Almost immediately, all interior crews were accounted for at the entry doorway. The engine captain sustained 2nd degree burns to his face. No other injuries were reported. Crews quickly regrouped.

Later arriving companies were assigned to the fire attack, and the fire was quickly contained.

<u>Report#10-041</u>

Upon arrival, the crew of the first-in engine found **heavy smoke coming from a 2 1/2 story single family dwelling**. Crews quickly realized the fire was located in the basement. Two crew members stretched a line into the first floor to hold the fire to the basement as per the departments SOP. The remainder of the crew went around to the rear and attempted to enter the basement from an exterior entrance without a hoseline for search. The crew was quickly driven out of the basement by the heavy fire conditions. Meanwhile, the crew on the first floor made their way to the rear of the first floor where the interior stairwell entrance was located. They were able to keep the fire in the basement but the smoke was to the floor on the first floor. **Approximately 16 minutes into the incident, an officer notified command that the first floor inside the main entrance was starting to burn through. Command then asked for the evacuation tone after a short delay because the message was not originally heard. As the crew on the first floor turned to exit, they realized the floor was burned out in the front entrance. They then attempted to find a window when one of the firefighter's low air alarm began to sound on their SCBA. After a short time of searching around, the crew found a window but not before one of the firefighters ran out of air.** The firefighter called for a ladder, but a deputy chief outside did not recognize the severity of the situation and told the firefighter the front door was 25 feet to his right. The firefighter was now completely out of air and his partner was also beginning to run low. As conditions continued to worsen, he dove out the window with his partner right behind him.

Fortunately, there were bushes underneath the window that broke the firefighter's fall. Neither firefighter was injured.

Report#09-1020

It was about 11:10 pm, when companies were dispatched to a reported structure fire in a detached single-family dwelling. **Upon arrival, it was reported that light smoke was showing and all occupants were evacuated. Crews began searching for the fire. Conditions at the time were minimal and crews decided to search without stretching a hoseline**.

At approximately 11:40, conditions deteriorated and heavy smoke began to fill the second floor. Two crews were operating inside without a RIT established or any back-up crew waiting outside. The officer reported they were having difficulty locating the attic access. A three man crew went back to the second floor to search again. **Within a minute of reaching the floor, heavy smoke filled the hallway extending to the floor.** The officer indicated that he could not see his hand in front of his mask, even at floor level. The officer ordered his crew to evacuate the second floor. He had reached the top of the stairs as the last person came off the floor. At that point, **an explosion occurred and fire blew into the stair well burning a firefighter who was on the steps. The firefighter was rendered unconscious and fell to the bottom of the steps.** The officer fell backwards onto the landing and was momentarily disoriented. Upon gaining orientation, he proceeded down the steps and was joined by another firefighter who assisted in dragging the unconscious firefighter out of the structure.

The cause of the explosion was later determined to be a result of the other crew operating inside the structure, who had decided to breach an interior wall in search of the fire. Fortunately, the firefighters were in full PPE, but they did experience some minor burns.

Obtain Frequent Progress Reports and Revise the Action Plan.

Objective: To cause the incident commander, as well as all command organization officers, to obtain frequent progress reports, to continually assess fire conditions and any risk to firefighters, and to regularly adjust and revise the action plan to maintain safe operations.

NO GO: If you haven't obtained progress reports to develop/update the action plan.

Narrative

In order to keep the action plan safe and current, the incident commander must obtain frequent and ongoing progress reports from crews, and command organization officers, from all locations of the fire ground. Without ongoing reports, the incident commander cannot maintain situational awareness. National Near Miss Reporting System lists the top two categories of near fatal events as lack of "Situational Awareness" followed by "Decision Making". The next two categories are human error and individual action.

Situational awareness is defined as; the level of understanding and attentitiveness one has (the incident commander) regarding the reality of a set of conditions (fire conditions and fireground operations). When situational awareness is high, there is rarely a surprise. When situational awareness is low or absent, "unexpected" events occur (that can injure or kill firefighters). Simply put, situational awareness is the relationship between what one perceives is happening and what is really happening.

The set of conditions that affects situational awareness can be broken down into three divisions: a lack of information (incomplete size up and lack of progress reporting), a lack of knowledge (lack of training, information) and a lack of cognition (not understanding what is being heard or observed). These three divisions are made up of their own unique factors, including misinterpreting conditions and surroundings, not recognizing factors and cues, gather incomplete information, being narrow focused and being impaired.

Simply put – The incident commander must be aware of all conditions and operations on the fireground and understand/comprehend what is happening. The incident commander must always be in control of firefighter actions and risk – ALL THE TIME!

The incident commander cannot maintain full situational awareness without obtaining frequent and ongoing progress reporting. The incident commander cannot make good decisions without good information. He must also LISTEN to what's being said and understand what he is hearing. If there is any uncertainty about a progress report, the incident commander must conduct a follow up and request clarification. If any report sounds confused, or there is any uncertainty about the report, it must be assumed to be a worst case situation until certainty and clarity is obtained.

The incident commander cannot develop a safe action plan, or keep it current, without progress reports. The incident commander must recognize that the action plan is fluid and changes with changing fire conditions and progress reports.

Conditions on the fireground will be constantly changing, often deteriorating. The incident commander MUST conduct continuous assessment of tactical operations, changing fire conditions, and risk to firefighters from all points on the fireground and quickly revise the action plan. The Incident commander must stay ahead of the fire. He can't do this without frequent, ongoing progress reporting

Bottom line. If the incident commander can't obtain progress reports and keep the action plan current don't commit to interior operations.

Teaching Points

- *The incident commander cannot maintain situational awareness of the fireground operations, nor be able to develop a safe action plan, without obtaining frequent progress reports from crews and command team officers.*

- *The National Near Miss Reporting System lists the top two categories of near fatal events as lack of "Situational Awareness" followed by "Decision Making". The next most frequently reported causes of near miss reports are; human error, and individual action.*

- *Situational awareness is defined as; the level of understanding and attentitiveness one has (the firefighter) regarding the reality of a set of conditions (fire conditions and fireground operations). When situational awareness is high, there is rarely a surprise. When situational awareness is low or absent, "unexpected" events occur (that can injure or kill firefighters). Simply put, situational awareness is the relationship between what one perceives is happening and what is really happening.*

- *The set of conditions that affects situational awareness can be broken down into three divisions: a lack of information (incomplete size up and lack of progress reporting), a lack of knowledge* (*lack of training, information*) *and a lack of cognition* (not understanding what is being heard or observed). *The these three divisions are made up of their own unique factors, including misinterpreting conditions and surroundings , not recognizing factors and cues, gathering incomplete information, being narrow focused and being impaired.*

- *Another "simply put" – The incident commander must be aware of all conditions and operations and understand/comprehend what is happening and in control of firefighter actions and risk – ALL THE TIME!*

- *Frequent progress reports allow the incident commander to maintain a high level of situational awareness.*

- *Good decisions can't happen without obtaining a 360 size up of the fireground and obtaining frequent progress reports.*

- *The incident commander cannot make good decisions without good information – thus, the need for frequent progress reports. He must also LISTEN and understand what his hearing.*

- *Conditions on the fireground will be constantly changing, often deteriorating. The Incident Commander MUST conduct a continuous assessment of tactical operations, changing fire conditions, and risk to firefighters and update the action plan.*

- *The action plan is fluid and changes with conditions on the fireground. The incident commander must stay ahead of the fire with the action plan*

- *In order to continually revise and update the action plan, the Incident Commander must obtain frequent progress reports from all points on the fireground and quickly revise the action plan. The Incident commander must stay ahead of the fire.*

- *The action plan must be revised and updated based on this assessment.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which the incident commander did not obtain frequent or adequate progress reports to continually assess the fire conditions and revise the action plan, including:

Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom – South Carolina;

http://www.cdc.gov/niosh/fire/reports/face200718.html

On June 18, 2007, nine career fire fighters (all males, ages 27 – 56) died when they became disoriented and ran out of air in rapidly deteriorating conditions inside a burning commercial furniture showroom and warehouse facility. **The first arriving engine company found a rapidly growing fire at the enclosed loading dock connecting the showroom to the warehouse.** The Assistant Chief entered the main showroom entrance at the front of the structure but did not find any signs of fire or smoke in the main showroom. He observed fire inside the structure when a door connecting the rear of the right showroom addition to the loading dock was opened. **Within minutes, the fire rapidly spread into and above the main showroom, the right showroom addition, and the warehouse. The burning furniture quickly generated a huge amount of toxic and highly flammable gases along with soot and products of incomplete combustion that added to the fuel load. The fire overwhelmed the interior attack and the interior crews became disoriented when thick black smoke filled the showrooms from ceiling to floor.**

The interior fire fighters realized they were in trouble and began to radio for assistance as the heat intensified. One fire fighter activated the emergency button on his radio. The front showroom windows were knocked out and fire fighters, including a crew from a mutual-aid department, were sent inside to search for the missing fire fighters. Soon after, the flammable mixture of combustion by-products ignited, and fire raced through the main showroom. **Interior fire fighters were caught in the rapid fire progression and nine fire fighters from the first-responding fire department died**. At least nine other fire fighters, including two mutual-aid fire fighters, barely escaped serious injury.

Structure Fire Claims the Lives of Three Career Fire Fighters and Three Children – Iowa

http://www.cdc.gov/niosh/fire/pdfs/face200004.pdf

On December 22, 1999, a 49-year-old Shift Commander (Victim #1) and two Engine Operators, 39 and 29 years of age respectively (Victim #2 and Victim #3), lost their lives while performing search-and-rescue operations at a residential structure fire. At approximately 0824 hours, Central Dispatch was notified of a structure fire with three children possibly trapped inside. At approximately 0825 hours, a Shift Commander and an Engine Operator (Victim #1 and Victim #2) were dispatched to the scene. At 0827 hours, Engine 3 (Lieutenant and Victim #3) responded to the scene. **Aerial Truck 2 approaching the scene, reporting via radio that white to dark brown smoke was showing from the residence, and requested six additional fire fighters.** When Aerial Truck 2 arrived on the scene at 0830 hours, 2 witnessed a woman and child trapped on the porch roof, and they were informed that three children were trapped inside the house. Victim #1 proceeded into the house to perform a search-and-rescue operation. Engine 3 arrived on the scene shortly after, and the Lieutenant connected a supply line to the hydrant as Victim #3 pulled the Engine into position. The Lieutenant and Victim #3 stretched a 5-inch supply line and connected it to Aerial Truck 2. At approximately 0831 hours, the Chief and Fire Fighter #1 arrived on the scene, and the Chief assumed Incident Command (IC). At this time, **one of the victims removed the first of the three children from the structure, handed the child to a police reserve officer near the front entrance of the structure (the child was pronounced dead at the hospital)**, and returned to the structure to continue search and-rescue operations. At this time one **of the victims removed a second child. The IC grabbed the child and began cardiopulmonary resuscitation (CPR). Due to limited personnel on the fireground, the IC directed a police officer on the scene to transport him and the child to the hospital**. After donning her gear, Fire Fighter #1 approached the front door and noticed that the 1½-inch handline (previously stretched) had been burned through and water was free-flowing. It is believed that the three victims were hit with a thermal blast of heat before the handline burned through. The three victims failed to exit as 12 additional fire fighters arrived on the scene began fire suppression and search-and-rescue operations. Victim #2 was located, removed, and transported to a nearby hospital, where he was pronounced dead. Victim #1 and Victim #3 were later found and pronounced dead on the scene.

NEAR MISS REPORTS

Report#07-908

All hands were working at a 4 alarm fire, involving three, balloon framed, three story, 30'x75' tenement houses. Heavy structural damage was sustained by the center (origin) structure. Exposure "B"

experienced exterior fire damage as well as a fully involved attic space. The "D" exposure received exterior fire damage. A crew of three firefighters was operating an exterior handline between the original structure and the "B" exposure. At this time the major body of fire had been controlled, leaving several stubborn pockets of fire to deal with. **The Incident Safety Officer (ISO) noted the crew's position and evaluated the safety of the operation against the risk involved. The center building had been severely weakened by the fire and it was determined that the benefit did not merit the risk. The ISO ordered the crew to move the line to the adjacent yard at the rear of the building.** This would place them safely out of the collapse zone. **Approximately five to ten minutes later the structure suffered a sudden, catastrophic collapse,** sending most of the debris to the area where the crew had been operating before the move. This could easily have resulted in death for our members. Instead it was a non-event.

Report#05-418

Units responded to automatic alarm at church. While enroute, incident was upgraded to full alarm assignment on reports of fire in the "red brick" building. First alarm assignment consisted of Q(X), E(X), E(XX), E(XXX), E(IV), B(X). Q(X) and E(X) **arrived 1st with nothing visible from large church.** Q(X) took command and positioned on the south side, and E(X) positioned on the North-side. **On investigating E(X) reported working fire on second story and was stretching line to attack fire. Approximately 1 minute after arrival command requested 2nd alarm and sent Q-crew in to assist with evacuation and investigation. At 2 minutes in command advised that smoke condition had changed, and warned interior crews that they possibly had a "well charged attic".**

E(X) acknowledged and proceeded to attempt to locate and extinguish a fire located in 1 room (per radio report). **At approx 4 min in E(XX) reported fire at an exterior porch and ceiling starting to come in on the north side**. As B(X) arrived and assumed command, radio time was hampered with the request for additional resources such as police and our laundry list of things. At approximately 6 minutes in we had approximately 3 big boosters and 1 super booster operating. Units on the interior were requesting more pressure. **At approximately 8 minutes in, units were not reporting any progress and command was debating a switch to defensive operations. At this point a total of 3 maydays were transmitted by interior crews with members lost and off of hose lines.** E(X) firefighter ended up outside the building and was out of air. His lieutenant was left in the building.

At this point the decision to go defensive was made, and all members were ordered out. E(XX), knowing the situation, decided to stay and was able to find E(X) lieutenant, who was lost and low on air. All companies were able to exit and after a large aerial assault the fire was brought under control.

Report#06-234

Multiple companies operating at a residential fire that started in the walk-out basement. The 1st due Engine arrived and stretched a 2 1/2" through a garage that led directly into the basement area. Other companies stretched 2- 1 3/4" lines into the first floor. I arrived and was assigned by the IC to assist in the basement. **After operating for the life of my 30 minute SCBA, I exited to change bottles and observed that conditions had not improved, but deteriorated. As I re-approached the scene, the IC (B/C) pulled everyone out, and an aerial was used to darken down the fire.** While this was being set-up

the Company Officers met, and **the comment was made by one that the first floor had a hole in it that you could put a car in. This information was never relayed to the IC or other companies operating on-scene**. After using the Aerial, some company officers wanted to re-enter even though additional portions of the interior structure had collapsed.

Ensure Accurate Accountability of Every Firefighter Location and Status.

Objective: To cause the incident commander, and command organization officers, to maintain a constant and accurate accountability of the location and status of all firefighters within a small geographic area of accuracy within the hazard zone and aware of who is presently in or out of the building.

NO GO: If you don't know where firefighters are on the fireground at all times.

Narrative

In order to keep firefighters safe, the incident commander must know where they are on the fireground at all times. Firefighter accountability is a critical responsibility of the incident commander and brings us to the next Rule;

All fire departments must adopt a legitimate and recognized firefighter accountability system. Key components of a recognized system include the ability to accurately know which firefighters are presently in the building and which are out. The system must also be able to identify, within a small geographic area of operation, where every firefighter is located at any moment in time. It means that in order to maintain accuracy, accountability must be managed at the point(s) of entry by a dedicated member and that member must remain on the exterior. A recognized system includes tags, passports, or other means of documentation which must be maintained at the points of entry. (A collection of tags at the command post only means the IC has a collection of names of potential fatalities).

Initially, the engineer/pump operator of the engine company should assume the accountability responsibility. His pump just happens to be supplying an attack line that go to a point of entry (sometimes supplying attack lines to more than one point of entry). As the incident begins to escalate and more resources arrive on scene a dedicated member should be assigned accountability responsibilities. This could be a staff officer, chief officer, or splitting up a company and sending members to different points of entry to assume accountability duties. The ID tags, etc., must be collected at the point of entry by the accountability officer. As the firefighter exits the building (i.e. to refill his SCBA) he retrieves his tag. Upon re-entry to the building, the tag is turned into the accountability officer.

The system must include "Personnel Accountability Reports" (PAR's) at appropriate bench marks during the incident to confirm all is well with firefighters operating in the hazard zone. These include a PAR at 30 minutes on scene (about the time the first wave of firefighters will be running out of air), anytime a hazardous event occurs on the fireground (i.e. flashover, partial collapse), immediately after crews are ordered out of the building, when the fire is declared under control, *or anytime the incident commander desires.*

Ensuring accurate firefighter accountability does not mean the incident commander becomes directly involved in managing the system. It does mean he is responsible for ensuring that the command team has implemented an effective accountability system and it's functioning properly.

Another important component to the accountability system is the tactical worksheet. It is not, in itself, an accountability system, but does serve as an accountability support system. This is a written document that logs the location of all fire companies operating on the scene (member names are not listed – only company ID's). It must be initiated at the outset of operations and document where fire companies or crews are assigned on the fireground. It also serves as an effective briefing tool as command is transferred to a senior officer or the Operations Section Chief is implemented.

Progress reporting is another method for the incident commander and/or the division or group supervisor to maintain situation awareness of accountability. On-going progress reports not only keep these officers informed as what is happening with the fire, it also maintains awareness of fire crew current locations, their actions, and welfare. If the incident commander or division or group officers fail to get a response from a fire crew for a request for a progress report a follow-up radio request should occur. If after the third radio call there is no response, it must be assumed there is a problem. The incident commander must use adjacent crews, or other means, to confirm the crew is safe, including committing the RIT and declaring a May Day if there is no response or other contact.

Part of the incident commander's responsibility to firefighter accountability is his ability to listen and hear communications clearly and MUST be able to hear a May Day call. At the report of any May Day the incident commander must know were all crews are operating on the fireground. A May Day also mandates that a personnel accountability report (PAR) is initiated immediately. This is necessary to confirm who, and how many firefighters may be lost/trapped, etc.

Firefighter accountability information is also important rapid intervention teams (RIT's). The accountability system must be able to quickly pass on firefighter location data to the RIT. Any RIT's entering the building in response to a May Day must also turn in their ID tags or passports.

Freelancing must be strictly prohibited by any crew or individual firefighter. Crews must under the direction and awareness of the incident commander (or command team supervisor). Firefighters must always be under the control and supervision of their company officer.

Bottom line: If you don't have an accountability system in place, or you don't know where firefighters are, don't commit to interior operations.

Teaching Points

NO GO; If you don't have a legitimate accountability system, the firefighter is placed at extreme risk.

- *All fire departments must adopt a legitimate and recognized firefighter accountability system.*

- *Key components of a recognized system include the ability to accurately know who is presently in the building and who is out at all times.*

- *The system must be able to identify, within a small geographic area of operation, where every firefighter is located at all times.*

- *It means that in order to maintain accuracy, accountability must be managed at the point(s) of entry by a dedicated fire officer and that officer must remain on the exterior.*

- *A recognized system includes tags, passports, or documentation that initially arrives with the first companies on scene and maintained at the points of entry to a designated accountability officer. (A collection of tags at the command post only means the IC has a collection of names of potential fatalities).*

- *The system must include "Personnel Accountability Reports" (PAR's) at appropriate bench marks during the incident. These include a PAR at 30 minutes on scene (about the time the first wave of firefighters will be running out of air), anytime a hazardous event occurs (i.e. flashover, partial collapse), immediately after crews are ordered out of the building, when the fire is declared under control, or anytime the incident commander desires.*

- *Activation of the accountability system starts with the initial incident commander- often the first company officer on the scene.*

- *Initially, the engineer/pump operator of the engine company should assume the accountability responsibility. His pump just happens to be supplying an attack line that go to a point of entry (sometimes supplying attack lines to more than one point of entry).*

- *As the incident begins to escalate and more resources arrive on scene a dedicated member should be assigned accountability responsibilities. This could be a staff officer, chief officer, or splitting up a company and sending members to different points of entry to assume accountability duties.*

- *The ID tags, passports etc., must be collected at the point of entry by the accountability officer. As the firefighter exits the building (i.e. to refill his SCBA) he retrieves his tag. Upon re-entry to the building, the tag is turned into the accountability officer.*

- *In addition to the accountability system of tags, passports, etc., the incident commander must initiate a "tactical worksheet" at the outset of operations and document where crews are assigned on the fireground.*

- *The ultimate responsibility for crew integrity and ensuring no members get separated, or lost, rests with the company officer or lead buddy team member. They must maintain constant contact with their assigned members by voice, touch or visual observation while in the hazard zone. They must ensure their team stays together. If any of these elements are not adhered to, crew integrity is lost and firefighters are placed at great risk.*

- *Freelancing must be strictly prohibited by any crew or individual firefighter. Crews must under the direction and awareness of the incident commander (or command team supervisor). Firefighters must always be under the control and supervision of their company officer.*

- *Anytime the incident commander or command organization officer cannot contact a crew/firefighter, the worst must be assumed. The incident commander must request a personnel accountability report from all company officers and crew. The RIT must be sent to the last known location to begin a search until it is confirmed that the missing member is determined safe.*

- *Once the 360 degree size up is completed the incident commander must assume a stationary position at a command post. This will allow more convenient documentation of the tactical worksheet. It further allows other responding agencies (fire departments, police, EMS, utilities, etc.) to quickly locate the incident commander and be integrated into a unified command system.*

- *The best location for a command post is in a vehicle in front or at the front corner (or other location that maximizes observation possibilities). This may be the cab of an engine or ladder company initially and later in a chief officer's vehicle or specialized command vehicle. These vehicles provide more powerful radios, better lighting, and a quieter environment for communications (i.e. away from diesel engine noise). The incident commander MUST be able to listen and hear communications clearly and <u>MUST be able to hear a May Day call.</u>*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which the lack of an accountability system or the command organization lost awareness of firefighter accountability became a contributing factor to fire fighter LODDs including:

Career Fire Fighter Dies of Carbon Monoxide Poisoning after Becoming Lost While Searching for the Seat of a Fire in Warehouse - New York

http://www.cdc.gov/niosh/fire/pdfs/face200404.pdf

On December 16, 2003, a 30-year-old male fire fighter (the victim) died after he became separated from his crew members while searching for the seat of a fire at a furniture warehouse. His crew exited due to worsening conditions and a missing member announcement was made. At one point while inside the warehouse, members of an engine crew thought they heard a scream but could not identify the source. After an evacuation order was given and as engine crew members were exiting, **the victim's officer mistakenly identified one of them as the missing member and cancelled the emergency message**. Once fire fighters had exited, a personnel accountability report (PAR) was taken several minutes later on the street which revealed that the victim was still missing. The victim's officer initiated a second emergency message for a missing member and a search was begun. The victim, who had a working radio, was found lying face down with his face piece removed and 900 psi left in his self-contained breathing apparatus (SCBA). His Personal Alert Safety System (PASS) alarm was reported by fire fighters to be inaudible. His carboxyhemoglobin (COHb) level was 74.8% in the emergency room. The victim did not declare a May Day and did not activate his radios emergency alert button. **The victim did not declare a May Day and did not activate his radios emergency activation button.**

Structure Fire Claims the Lives of Three Career Fire Fighters and Three Children–Iowa

On December 22, 1999, a 49-year-old Shift Commander (Victim #1) and two Engine Operators, 39 and 29 years of age respectively (Victim #2 and Victim #3), lost their lives while performing search-and-rescue operations at a residential structure fire. At approximately 0823 hours, the three victims and two additional fire fighters cleared the scene of a motor-vehicle incident. One of the fire fighters (Fire Fighter #1) riding on Engine 3, joined the ambulance crew to transport an injured patient to the hospital. At approximately 0824 hours, Central Dispatch was notified of a structure fire with three children possibly trapped inside. At approximately 0825 hours, Central Dispatch notified the fire department, and a Shift Commander and an Engine Operator (Victim #1 and Victim #2) were dispatched to the scene in the Quint (Aerial Truck 2). At 0827 hours, Engine 3 (Lieutenant and Victim #3) responded to the scene. At 0829 hours as Aerial Truck 2 approached the scene, they radioed Central Dispatch, reporting white to dark brown smoke showing from the residence, and requested six additional fire fighters. Aerial Truck 2 arrived on the scene at 0830 hours. The crew of Aerial Truck 2 witnessed a woman and child trapped on the porch roof, and they were informed that three children were trapped inside the house. A police officer who was already on the scene positioned a ladder to the roof and removed the woman and child as **Victim #1 proceeded into the house to perform a search-and-rescue operation**. Engine 3 arrived on the scene shortly after, and the Lieutenant connected a supply line to the hydrant as Victim #3 pulled the Engine into position. The Lieutenant and Victim #3 stretched a 5-inch supply line and connected it to Aerial Truck 2. At approximately 0831 hours, the Chief and Fire Fighter #1 arrived on the scene, and the Chief assumed Incident Command (IC). **(NOTE; Total of 6 firefighters on scene. Four arrived on two apparatus and the fire chief picked one firefighter up at the hospital)** Fire Fighter #1 **pulled a 1½-inch handline off**

Aerial Truck 2, through the front door and placed it in the front room. The IC instructed Victim #2 and Victim #3 to don their protective gear and proceed into the house to assist in the search-and-rescue operations. Fire Fighter #1 went back to Aerial Truck 2 to gear up. At this time, **one of the victims removed the first of the three children from the structure, handed the child to a police reserve officer (deceased)** near the front entrance of the structure, and **returned to the structure to continue search-and-rescue operations.** The police reserve officer transported the child to a nearby hospital. The IC charged the handline from Aerial Truck 2 and went to the structure. At this time **one of the victims removed a second child (also deceased).** The IC grabbed the child and began cardiopulmonary resuscitation (CPR). Due to limited personnel on the fireground, the IC directed a police officer on the scene to transport him and the child to the hospital. After donning her gear, **Fire Fighter #1 approached the front door and noticed that the 1½-inch handline (previously stretched) had been burned through and water was free-flowing. It is believed that the three victims were hit with a thermal blast of heat before the handline burned through.** The three victims failed to exit as 12 additional fire fighters arrived on the scene through a call-back method and began fire suppression and search-and-rescue operations. Victim #2 was located, removed, and transported to a nearby hospital, where he was pronounced dead. Victim #1 and Victim #3 were later found and pronounced dead on the scene.

If After Completion of the Primary Search, Little or No Progress Towards Fire Control Has Been Achieved, Seriously Consider a Defensive Strategy.

Objective: : To cause a benchmark decision point, following completion of the primary search, requiring the incident commander to consciously determine if it's safe to continue offensive interior operations where progress in controlling the fire is not being achieved and there are no lives to be saved.

Narrative

It is standard practice for fire departments to initiate primary search and rescue operations at fires where it is safe to do so. Once the primary search is declared completed (all clear) the only living Human Beings left in the building is firefighters.

A report that the primary search is completed (all clear), or when fire conditions don't allow for occupant survival, is always a critical benchmark for decision making and action plan development by the incident commander. It's a point in time where the incident commander must confirm the current strategy or change it. This decision point is especially important to firefighter safety where fire crews are still in the building.

If the primary search has been completed, or it's determined there are no lives to be saved, and the first wave of fire operations has not made progress on controlling the fire, operations may now have entered a marginal situation and a very dangerous period for the firefighter.

No fire attack or building is worth the life of a firefighter. Nearly all buildings that are lost to fire are rebuilt. If fire control cannot be obtained, the incident commander must seriously consider the withdrawal of crews! A defensive strategy must next be implemented. The incident commander also must understand that withdrawing crews often takes longer than it took for them to penetrate to operating positions. The withdrawal must occur early enough to allow adequate time for fire crews to safely exit the building and before the fire can harm them. If crews are ordered to evacuate the building a personnel accountability report (PAR) must be obtained to confirm all firefighters have indeed been evacuated successfully and accounted for.

If withdrawal is ordered a personnel accountability report must be obtained to confirm all firefighters have indeed been evacuated successfully and accounted for. A round robin request for progress reports from command organization officers will provide information necessary to change and update the action plan.

Recent research by Underwriters Laboratory's determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.

The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover, **the time from onset of untenability to flashover was less than 10 seconds!** This DOES NOT allow much of a survival period for the firefighter to exit a building.

The incident commander should also be aware of the affects of wind on fire development and intensity. Any wind over 10 mph begins to have increasing dangerous affects by dramatically increasing the intensity of fire conditions in a building and rapidly increase risk to any firefighters downwind while in a building. The higher the wind speed the more intense the fire conditions. Once downwind windows fail or doors are opened, wind will rapidly push the fire onto firefighters almost instantly and minimizing survival time.

A smaller example of the effects of wind on fire is positive pressure ventilation. Anyone who has used positive knows there needs to be an exit point in or near the fire area. Where that exists the positive ventilation pushes fire out that window in a blow torch fashion running horizontal for several feet. If the door the firefighter is entering is downwind from the fire and a significant wind enters the building firefighters be subject to a much greater blow torch affect than created by positive pressure ventilation.

Bottom line: If there are no occupants in the building, or there is no survival possible, and the fire can't be controlled, don't continue interior operations – evacuate the building and implement a defensive strategy.

Teaching Points

NO GO

- *This is a critical bench decision point related to action plan development and firefighter safety.*

- *Once the primary search is declared completed (or it was determined that it was unsafe to conduct a primary search) or it's determined there are no lives to be saved, the only living Human Beings in the building are firefighters.*

- *If it's determined there are no lives to be saved, and the primary search has been completed, and the first wave of firefighting operations has not made progress on controlling the fire, operations have now entered a marginal and very risky period for firefighters.*

- *No fire attack or building is worth the life of a firefighter. Most buildings that are lost to fire are re-built. If fire control cannot be obtained the incident commander should withdrawal fire crews before they are harmed and seriously consider a defensive strategy.*

- *If the first wave of fire operations has not made progress on controlling the fire, operations have now entered a marginal and very risky period for the firefighter.*

- *No fire attack or building is worth the life of a firefighter. If control cannot be obtained, withdrawal crews! A defensive strategy must now be implemented.*

- *The incident commander must ensure the order withdrawal occurs early enough to allow adequate time for fire crews to safely exit the building and before the fire can harm firefighters. The incident commander must understand that withdrawing crews often takes longer than it took for them to penetrate to operating positions.*

- *If withdrawal is ordered a personnel accountability report must be obtained to confirm all firefighters have indeed been evacuated successfully and accounted for.*

- *A round robin request for progress reports from command organization officers will provide information necessary to change and update the action plan.*

- *Recent research by Underwriters Laboratory's determined that a fire in a modern home can create a flashover in just 3 minutes and 40 seconds! This rapid flashover time for the modern home reflects today's typical contents – synthetics and plastics. Such rapid flashovers quickly reduce the survival profile of any trapped victims as well as increasing risk to firefighters.*

- *The research also showed, in many experiments, that if a firefighter is in a room about to reach flashover,* ***the time from onset of untenability to flashover was less than 10 seconds!*** *This DOES NOT allow much of a survival period for the firefighter to exit a building.*

- *Beware of lightweight construction and early collapse potential – for both the roof and floors, particularly over a basement fire. Underwriters Laboratory test determined some lightweight unprotected truss system can collapse as early as 6.5 minutes after flame impingement – and without warning.*

- *Abandoned and dilapidated buildings are a particular risk to firefighters and experience has shown there is little likelihood of containing any occupants. Where the fire cannot be quickly controlled, serious consideration should be given to a defensive strategy.*

- *Beware of wind driven fires as they can almost instantly create an intense fire once a upwind window fails or a door is opened that can easily roll over firefighters. Where high wings exist, the safest approach is fire crews attack the fire from the upwind side.*

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents at which incident commanders delayed converting to a defensive strategy or where a defensive strategy was undertaken, then switched back to offensive operations, resulting in fire fighter LODDs including:

Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom – South Carolina;

http://www.cdc.gov/niosh/fire/reports/face200718.html

On June 18, 2007, nine career fire fighters (all males, ages 27 – 56) died when they became disoriented and ran out of air in rapidly deteriorating conditions inside a burning commercial furniture showroom and warehouse facility. The first arriving engine company found a rapidly growing fire at the enclosed loading dock connecting the showroom to the warehouse. **Within minutes, the fire rapidly spread into and above the main showroom, the right showroom addition, and the warehouse. The burning furniture quickly generated a huge amount of toxic and highly flammable gases along with soot and products of incomplete combustion that added to the fuel load. The fire overwhelmed the interior attack and the interior crews became disoriented when thick black smoke filled the showrooms from ceiling to floor. The interior fire fighters realized they were in trouble and began to radio for assistance as the heat intensified. One fire fighter activated the emergency button on his radio.** Officers working outside the structure initially did not hear the radio Mayday until an off-duty officer responding to the scene in his personal vehicle heard the Mayday and advised the Chief that a Mayday was being called over the radio. The front showroom windows were knocked out and fire fighters, including a crew from a mutual-aid department, were sent inside to search for the missing fire fighters. Soon after, the flammable mixture of combustion by-products ignited, and fire raced through the main showroom. Interior fire fighters were caught in the rapid fire progression and nine fire fighters from the first-responding fire department died. At least nine other fire fighters, including two mutual-aid fire fighters, barely escaped serious injury.

Two Career Fire Fighters Die and Captain is Burned When Trapped during Fire Suppression Operations at a Millwork Facility – North Carolina

http://www.cdc.gov/niosh/fire/pdfs/face200807.pdf

On March 7, 2008, two male career fire fighters, aged 40 and 19 (Victims #1 and #2 respectively) were killed when they were **trapped by rapidly deteriorating fire conditions inside a millwork facility** in North Carolina. The captain of the hoseline crew was also injured, receiving serious burn injuries. The victims were members of a crew of four fire fighters **operating a hoseline protecting a firewall in an attempt to contain the fire to the burning office area** and keep it from spreading into the production and warehouse areas. The crew separated when a fire fighter ran low on air and followed the hoseline to the outside. **The captain attempted to radio for assistance as the conditions deteriorated but fire fighters on the outside did not initially hear his Mayday.** The captain sent a second fire fighter (Victim # 2) outside to relay information about their condition. Victim # 2 talked with the Incident Safety Officer, and then returned to re-join his crew. Once it was realized that the crew was in trouble, multiple rescue attempts were made into the burning warehouse in an effort to reach the trapped crew

as conditions deteriorated further. Three members of a rapid intervention team (RIT) were hurt rescuing the injured captain. Victim #1 was located and removed during the fifth rescue attempt. Victim #2 could not be reached until the fire was brought under control. The fourth crew member had safely exited the burning warehouse prior to the deteriorating conditions that trapped his fellow crew members.

NEAR MISS REPORTS

Report#09-257

Rapidly expanding fire involving three single family structures (wood frame). The initial fire unit was in the middle and fire was spreading in both directions, but more to the "B" exposure. Defensive hoselines were operating on the fire unit (middle) while aerial operations were being set up. At the same time, crews were asked to search the exposures. **After completing the primary search on the "B" exposure, crews re-entered the structure to fight the fire that had now spread to the interior of the "B" exposure. The Division Supervisor was aware of this, but the IC was not.** Aerial master stream operations began and the fire unit (middle) was controlled. The aerial master stream then swept over to the B exposure and pushed fire and roofing material down on to the interior crews. After discussing this with the Division Supervisors, the Incident Commander and the Officer of the elevated master stream, it was evident that clear objectives were not communicated. The Officer of the elevated master stream did not have a clear understanding of what their objective was and who they reported to; the Division Supervisor and the IC were not effectively coordinating the attack.

Always Have a Rapid Intervention Team in Place at All Working Fires.

Objective: To cause the incident commander to have a rapid intervention team in place ready to rescue firefighters at all working fires.

NO GO: Don't commit fire crews to high risk operations without a RIT in place.

Narrative

A fireground operation is a risky business. Even with the best safety practices unexpected events can occur that trap firefighters or they become lost in the building. For this reason, the incident commander must always have a rapid intervention team(s) (IRT's) in place at all working fires. This would also include compliance with the OSHA "two-in, two-out" rule for initial operations followed by assigning a fully staffed rapid intervention Team. For larger fires, or where unusual risks exist, an expanded RIT may be required utilizing more than one crew and supervised by a chief officer (i.e. Rescue Group – two engines, a ladder, ambulance and chief officer).

Rapid intervention teams should be reserved solely for firefighter rescue with the exception of other critical life saving priorities – such as a civilian victim suddenly appearing at a window. They should not be used for firefighting duties because the incident commander consumed all resources on scene and hasn't called for an additional alarm. Once committed, all RIT commitments must immediately be replaced with another RIT (preferably from staging). If no other resources are available, the incident commander should request another alarm or an adequate number of mutual aid companies.

Should a May Day be declared and the RIT committed firefighters will tend to "push the envelope" in regards to safety based on the nature of the event (rescuing one of their own) and the emotion involved. To ensure an acceptable risk, the incident commander should assign a "Rescue Group" supervisor (preferably a chief officer) and a safety officer to manage and oversee the search operation. Additionally, in order to maintain and supervise two major simultaneous operations – a firefight to protect the search and rescue effort AND a RIT operation, the incident commander should special call additional chief officers to fill critical command organizational positions.

The incident commander must understand that it may take several RIT members to find and then extract a downed firefighter. Research conducted by the Phoenix and Seattle fire departments, in buildings of approximately 5,000 square feet, determined that an average of 11–12 members were required to rescue a downed firefighter. Additionally, it took between 19-21 minutes to complete a rescue and extract the firefighter. While these exercises were conducted in large square foot buildings, and rescue of a firefighter from a smaller building may be quicker, it does reflect the realities of time SCBA air consumption and resources required.

It should be noted that the research was conducted in simulated NON- FIRE conditions. The time to complete an actual rescue with active fire in the building that is producing heat, zero visibility, with wet and slippery floors littered with debris, etc., can be expected to be longer and the resources required greater. In short, rapid intervention may not be rapid.

Any May Day should mandate the request for the next level of alarm (or greater) or adequate mutual aid. The number of alarms requested should be adequate to address the expected rescue and firefighting needs while also keeping several companies in staging at all times. The request for resources should also include a medical component of adequate ambulances and paramedics.

A rapid intervention operation is also risky business. Research by the Phoenix Fire Department found that one in five rescuers became disoriented and lost in the building during simulated RIT exercises. This could be life threatening to a lost RIT member at an actual fire. Therefore, incident commander must also insure that there are adequate resources on scene to back up and rescue the RIT if needed.

Any commitment of a RIT to other life threatening emergencies must require an immediate replacement. Ideally, the replacement RIT should come from a fire company in staging. Special calling a replacement company takes time to arrive and leaves all firefighters exposed to greater risk.

Bottom line. Never conduct high risk interior firefighting operations without a rapid intervention team in place**.**

Teaching Points

NO GO

- *A fireground operation is a risky business. Always have a rapid intervention team(s) in place.*
- *Even with the best safety practices, unexpected and life threatening events can and do occur on the fireground. A RIT must be in place to rescue firefighter.*
- *In all cases of a working fire the OSHA "two-in, two-out" rule must be complied with for initial operations followed by assigning a fully staffed Rapid Intervention Team.*
- *For large or complex fires, or one with high risk, a Rescue Group should be established with more than one company (i.e. two engines, a ladder and an ambulance supervised by a chief officer.*
- *Rapid intervention teams should be reserved solely for firefighter rescue with the exception of other critical life saving priorities – such as a civilian victim suddenly appearing at a window. They should not be used for firefighting duties because the incident commander consumed all resources on scene and hasn't called for an additional alarm.*

- *Once committed, all RIT commitments must immediately be replaced with another RIT (preferably from staging). If no other resources are available, the incident commander should request another alarm or an adequate number of mutual aid companies.*

- *The incident commander must understand that it will take several RIT members to rescue a downed firefighter. Research conducted by the Phoenix and Seattle fire departments in buildings of approximately 5,000 square feet determined that an average of 11–12 members were required to rescue a downed firefighter. Additionally, it took an average of 19-21 minutes to complete a rescue and extract the victim.*

- *It should be noted that the research was conducted in simulated NON- FIRE conditions. The time to complete a rescue at an actual fire with active fire, heat, zero visibility, wet and slippery floors with debris on the floor can be expected to be longer and the resources required greater.*

- *A RIT operation is also high risk. The research also determined that 20 percent of the rescuers became disoriented the search exercises and got in trouble. In an actual fire, this can be life threatening. The incident commander must have back up RIT's in place to rescue the rescuers if needed. Additionally, a reserve number of fire companies should be maintained in staging.*

- *Any May Day should mandate the request for the next level of alarm or adequate mutual aid (or more) as well as maintaining adequate resources in staging during the rescue operation.*

- *Back up the RIT once they are committed in order to rescue the rescuers if needed. During a RIT commitment keep additional resources in staging for immediate commitment to the incident as needed.*

Recommended Checklist for the Incident Commanders Response to a "May-Day" or Lost Firefighter Incident

- Use the Term "May Day" for Any Firefighter in Trouble or Missing
- Always Assume the Firefighter is Lost in the Building
- Use Emergency Traffic "Radio Tone"/Air Horns to Declare a "May-Day"
- Immediately Request Additional Alarm(s)/Mutual Aid
- Include a Medical Component to the Response
- Commit the Rapid Intervention Team(s) to the Search Area
- Rapid Intervention Teams to Take Specialized Equipment, as Needed
- Immediately Initiate a Fireground Roll Call/Personnel Accountability Report (PAR) of Firefighters
- Utilize Staging to Control Responding Resources
- Withdrawal Companies from the Affected Area, if Appropriate, for Roll Call and Recon Information
- Change the Strategic Plan to a High Priority Rescue Plan/Operation
- Re-enforce Fire Control Positions to Protect the Search Area.
- Assign a Chief Officer to the Search Effort/Group, Division
- Assign a Safety Officer to the Search Area/Group, Division,
- Back Up the Rapid Intervention Teams
- Expand the Command Organization at a Pace that Gets Ahead, and Stays Ahead, of Critical Needs
- Special Call Additional Chief Officers to Fill Command Positions(i.e. Divisions, Groups)
- Establish and Staff Treatment and Transportation Groups/Sectors Early
- Maintain Strong Supervision and Control of All Crews
- Open/Unlock All Doors, as Appropriate
- Ventilate, Establish Tenability of the Building
- Provide Lighting, as Needed
- Closely Coordinate and Control Search Efforts. No Missed or Duplicated Search Areas
- Special Call Technical or Specialty Teams as Needed (i.e. collapse)
- Watch for, Maintain Structural Stability of the Building
- Control, Stay Ahead of the Media
- Ensure that Dispatch is Monitoring All Radio Channels
- Ensure that the Command Post is Monitoring All Portable-to-Portable Radio Channels
- Activate a Welfare Branch/Group to Coordinate Hospital Support and Next of Kin Notification.

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents where a rapid intervention team was not in place to immediately initiate rescue operations which may have made a difference in the outcome, including:

Career Fire Fighter Dies After Becoming Trapped by Fire in Apartment Building – New Jersey

http://www.cdc.gov/niosh/fire/reports/face200118.html

On May 9, 2001, at 2037 hours, Central Dispatch received a call from a civilian reporting a structure fire. The career department was notified at 2037 hours, and the following apparatus responded: Engine 1 (Lieutenant, driver/operator, and fire fighter), Engine 2 (Lieutenant, driver/operator, and fire fighter), Engine 3 (Lieutenant, driver/operator, fire fighter), Truck 2 (Captain, Fire Fighter #1 [driver], and victim [tiller operator]) and Deputy Chief 4 (DC 4). Engine 2 was the first to arrive on the scene at 2039 hours, followed immediately by Truck 2. The Lieutenant of Engine 2 reported to Central Dispatch that they had **a working fire in a three-story brick building with fire showing in the rear.** He requested that all companies make hydrant connections. The driver of Engine 2 parked the apparatus to the north of the incident site on the A-Side of the building. Truck 2 parked directly behind Engine 2. The Lieutenant of Engine 2 then pulled the 200-foot, 1¾-inch preconnect "minute-man pack" from the passenger's side of the apparatus. As the Lieutenant from Engine 2 stepped back off the apparatus, he fell, twisted his ankle, and dropped the "minute-man pack." He then picked up the pile of hose and proceeded toward the street level door on the A-Side of the building. The fire fighter on Engine 2 proceeded toward the corner hydrant, to the north (approximately 160 feet) of Engine 2, with 400 feet of 4-inch supply line. Engine 3 arrived on the scene. At 2040 hours, DC 4 arrived on the scene, assumed incident command (IC), and conducted his initial scene size-up. A police officer approached him and reported that civilians were trapped on the second floor in Apartment #7. *Note: Other reports from civilians were that the trapped civilians were a mother and her two children.*

The IC informed the Captain of Truck 2 of the trapped civilians. Fire Fighter #1 and the victim were standing near Truck 2 when they **heard civilians yelling that there were people in Apartment #7. They proceeded to the building to conduct a primary search.** The Lieutenant from Engine 3 made forcible entry to the street-level door on the A-Side of the building. The Lieutenant from Engine 2 then followed the Lieutenant from Engine 3 into the first floor of the building with the preconnect from Engine 2. *Note: Fire fighters and officers reported to NIOSH investigators that the conditions on the first floor were clear with little to no heat, and that the conditions encountered on the second floor were light smoke with some heat.*

At 2041 hours, Engine 1 arrived and was ordered by the IC to stand by. The IC then called Central Dispatch and requested another engine. The Lieutenant from Engine 3 proceeded up the stairwell to the second floor and to the rear (C-Side) of the building. Following the Lieutenant from Engine 3, the Lieutenant from Engine 2 entered the building and dropped the "minute-man pack" in the stairwell. He proceeded with the nozzle to the second-floor landing and down the hallway toward the rear (C-Side), where he met the Lieutenant from Engine 3. At 2042 hours, Engine 4 (Lieutenant, driver/operator, and fire fighter) responded to the scene. **The Lieutenant from Engine 3 forced open the door to Apartment #8 and encountered heavy heat, fire, and smoke.** ***Note: Fire fighters and officers reported to NIOSH investigators that no civilians were seen or found inside the building at any time.***

The Captain from Truck 2 followed the hoseline into the building, unkinking the hoseline as he proceeded to the second floor to join the two Lieutenants at Apartment #8. The IC radioed the Lieutenant from Engine 3 to ascertain that they had made entry into the apartment. Replying in the

affirmative, the Lieutenant then radioed to the pump/operator of Engine 2 to charge the line. He began hitting the fire in the rear of the apartment but was having problems with low water pressure on the line. At 2043 hours, the pump/operator radioed the Lieutenant of Engine 2 that he was having problems with the throttle at the pump panel. *Note: The low-pressure problem resulted from throttle problems at the pump panel and the kinks in the charged line in the stairwell.*

The victim (carrying a sledgehammer) and Fire Fighter #1 (carrying a flathead ax) conducted a primary search of three second-floor apartments (#5, #6, and #7) while the two Lieutenants (from Engine 2 and Engine 3) and the Captain (Truck 2) were attacking the fire in the fourth apartment (Apartment #8). No civilians were found on the second floor. At 2044 hours, the interior attack team called for more water pressure. The Engine 2 pump/operator replied that he was still having problems with the throttle mechanism. Engine 4 arrived, and the IC ordered them in for additional manpower. **The victim and Fire Fighter #1 ascended the stairwell toward the third floor where they encountered heavy smoke and high heat.** The victim and Fire Fighter #1 descended the stairwell to the second-floor landing. Fire Fighter #1 told the victim to stay on the hoseline and to help the Lieutenants in Apartment #8 while he went to get some box lights from the truck. *Note: The box lights were to be placed at the top of the third-floor landing as a reference for their point of egress.*

At 2045 hours, fire fighters stretched a 1¾-inch backup line from Engine 2 to the second floor. At 2046 hours, members of a mutual-aid company began responding to the incident. At 2047 hours, the IC called Central Dispatch and requested Truck 1, which responded with a Lieutenant, driver, and a fire fighter. The victim radioed Engine 2 that he was trapped on the third floor. *Note: For approximately the next 70 seconds, the only radio traffic was between the IC and the Truck 1 officer, who were discussing the assignment and placement for Truck 1 upon their arrival. The IC and the Truck 1 officer did not discuss the victim. The fire department has only one radio channel available to be used as the tactical and fireground channel.*

At 2049 hours, the victim radioed Truck 2, reporting that he could not breathe and that he was trapped on the third floor. The victim radioed a third transmission that he was on the third floor, trapped, and needed help. The Lieutenant from Engine 3 heard the victim's third radio transmission and called "Mayday - Mayday" over the radio. The victim made a fourth transmission that he was on the third floor, trapped, and needed help. Central Dispatch transmitted, "We got a Mayday, Mayday. Dispatch, Dispatch to Deputy 4. We got a Mayday calling from the third floor." Command acknowledged Central Dispatch's notification of the Mayday. Trying to determine the victim's location, the Lieutenant from Engine 3 maintained radio contact with him. The victim responded that he was on the third floor, upstairs, and to the right. At 2050 hours, the victim radioed that there was heavy fire and that he couldn't get out. Approximately 1 minute later, he radioed that he was running out of air. The Lieutenant made numerous calls for a line to be brought up to the third floor. At 2052 hours, Truck 1 arrived and parked in the lot on the D-Side of the fire building). **Approximately 13 minutes after the victim had arrived on the scene, at 2053 hours, he made his final transmission that he was out of air. <u>At 2054 hours, the IC radioed for the mutual-aid company to report in as a fire fighter assist and search team (FAST).</u>** The Lieutenant from Engine 3 told Fire Fighter #1, who had just returned to the second-floor landing, that the victim had radioed that he was trapped in a third-floor rear apartment. The Lieutenant from Engine 2 attempted to stretch the initial attack line up the stairwell to the third floor but found that the line would not reach the rear apartments. *Note: The line was still fully charged and kinked in the stairwell between the first and second floors.*

Fire Fighter #1 followed the Lieutenant from Engine 2 to the third floor; however, he was forced to exit the building because he was low on air. The Lieutenant from Engine 3 advanced a handline down the hall toward Apartment #6 where he received an electric shock while attempting to knock down the fire. *Note: The department's SOPs list the shutting off of utilities as a Truck company function.*

At this incident, Truck 2 was immediately assigned to conduct a search for trapped civilians. Two fire fighters assisted the Lieutenant from Engine 3 out of the building, and emergency medical technicians (EMTs) provided him medical attention. Fire Fighter #1 got a ladder off Truck 2 and proceeded to the D-Side of the building. He positioned the ladder beneath the window of the third-story apartment where he believed the victim was located. Fire Fighter #1 broke the window, which was located in the kitchen of Apartment 12. He was unable to gain entry because a refrigerator blocked the window. At 2055 hours, a radio transmission was sent out asking the victim if he was still on the radio. The victim did not reply. The Administrative Director of the department arrived at this time to provide logistical support. At 2100 hours, the Chief of the department arrived and assumed command from the IC. Mutual-aid also arrived at this time. The IC radioed Central Dispatch requesting another engine and truck company for manpower. At 2102 hours, the fire fighter in the bucket of Truck 1 radioed that heavy fire was coming through the roof and the third floor rear. At 2103 hours, Engine 2 (additional mutual-aid) arrived. At 2104 hours, the IC radioed Central Dispatch for an additional ambulance. At 2105 hours, the fire fighter in the bucket of the ladder of Truck 1 radioed the IC that the rear of the third floor was fully involved. The Lieutenant from Engine 2 radioed from the interior that the rear of the second floor was fully involved. At 2107 hours, the fire fighter in the bucket of Truck 1 radioed the IC to get the fire fighters out of the building because "the whole rear of the roof is lit up." At 2110 hours, the fire fighter in the bucket of Truck 1 reported to command that the roof had partially collapsed into the third floor. At 2111 hours, the IC radioed Truck 1 on the status of the roof, and the fire fighter replied that "the rear of the building has collapsed and the front is lighting up." **The IC then ordered an evacuation of the building and a personnel accountability report (PAR) from all units. Truck 1 and Engine 2 knocked down the fire with master streams, allowing the fire fighter assist and search teams (FAST) several attempts to locate the victim.** *Note: The FAST was comprised of the on-duty personnel on the scene and not the mutual-aid company. While the FAST was operating on the interior of the building, the Administrative Director ordered Truck 1 to hit the fire on the roof with the aerial appliance. Fire fighters reported to NIOSH investigators that during one of the search attempts,* ***water applied to the roof by the aerial appliance forced the FAST to retreat down the hall.***

With each attempt by the FAST to locate the victim, the fire spread and conditions deteriorated in the building. The IC called for additional evacuations. On the fourth attempt by the FAST to find the victim, a Captain was using a thermal imaging camera when a member of the team heard a PASS device coming from Apartment #12. The FAST entered Apartment #12 and discovered the refrigerator door open in front of the door to the bedroom where the victim was found. The victim was lying face down on his PASS device, which was activated but barely audible. The victim was unresponsive and not breathing. *Note: There was a wall-mounted mirror in the bedroom that had been broken by the victim. The victim had struck the mirror and the wall numerous times with his sledgehammer. The mirror may have appeared to the victim to be a window.* Paramedics responded to the third floor where they pronounced the victim dead. The victim was then removed from the building at approximately 2300 hours.

A Volunteer Mutual Aid Captain and Fire Fighter Die in a Remodeled Residential Structure Fire – Texas

http://www.cdc.gov/niosh/fire/pdfs/face200729.pdf

On August 3, 2007, a 19 year-old male fire fighter (victim #1) and a 42 year-old male Captain (victim #2) responding from the same volunteer mutual aid department were fatally injured during a residential structure fire. While enroute, the fire district's Assistant Chief requested mutual aid from two neighboring departments due to dispatch updating the report to a fully involved structure fire. The Assistant Chief (Incident Commander) arrived on scene with four other fire fighters in an engine. The first interior attack crew entered the structure with flames visible in the foyer, approximately 1 minute later. The initial attack crew ran low on air, withdrew, and briefed a new interior attack crew (the victims) from the second mutual aid department on the location of a few hot spots to be knocked down and the presence of light smoke. Soon after, the IC requested ventilation. Horizontal and vertical ventilation was conducted and a powered positive pressure ventilation fan was utilized at the front door but little smoke was pushed out. Minutes later, heavy dark smoke pushed out of the front door. The IC made several attempts to radio the interior attack crew with no response. **Approximately 21 minutes after entry, an evacuation horn was sounded. A rapid intervention team (RIT) had been previously designated, then assigned to other tasks. A three member RIT was organized, made entry and located one of the victims, but was unable to fully extricate him. Ultimately, several RIT teams were necessary to recover the victims. Both victims died of smoke inhalation and thermal injuries.**

A Career Captain and an Engineer Die While Conducting a Primary Search at a Residential Structure Fire - California

http://www.cdc.gov/niosh/fire/reports/face200728.html

On July 21, 2007, a 34-year-old career captain and a 37-year-old engineer (riding in the fire fighter position) died while conducting a primary search for two trapped civilians at a residential structure fire. The two victims were members of the first arriving crew. They made a fast attack and quickly knocked down the visible fire in the living room. They requested vertical ventilation, grabbed a thermal imaging camera, and **made re-entry without a handline to search for the two residents known to be inside**. Another crew entered without a handline and began a search for the two residents in the kitchen area. A positive pressure ventilation fan was set at the front door to increase visibility for the search teams. **The second crew found and was removing one of the civilian victims from the kitchen area as rollover was observed extending from the hallway into the living room. Fire fighters became concerned for the air supply of both victims who were still in the structure. Crews conducted a search for the victims and found them in a back bedroom where they had been overcome by the rapid fire event.**

NEAR MISS REPORTS

Report#06-083

After arriving at a structure fire in a single family home, and having initiated the incident command system, I ordered two fire fighters that arrived on a call back apparatus to initiate a rapid intervention team. We had a well-involved structure with reports of a person trapped, and the fire was communicating to a second structure. **After the initial attack team entered, I noticed the RIT team putting their masks on and preparing to enter the building. Apparently, a Captain had ordered them into the building. The RIT team leader was upset he was "just standing around" so he solicited the**

Captain to go to work. I questioned the Captain and had them withdrawn from the building. The RIT team leader did not take the job seriously, and did not communicate his assignment to the Captain, leaving us without a RIT team at a very dangerous fire.

Report#09-1020

It was about 11:10 pm, when companies were dispatched to a reported structure fire in a detached single-family dwelling. Upon arrival, it was reported that light smoke was showing and all occupants were evacuated. Crews began searching for the fire. Conditions at the time were minimal and crews decided to search without stretching a hoseline.

At approximately 11:40, **conditions deteriorated and heavy smoke began to fill the second floor. Two crews were operating inside without a RIT established or any back-up crew waiting outside.** The officer reported they were having difficulty locating the attic access. A three man crew went back to the second floor to search again. Within a minute of reaching the floor, heavy smoke filled the hallway extending to the floor. The officer indicated that he could not see his hand in front of his mask, even at floor level. The officer ordered his crew to evacuate the second floor. He had reached the top of the stairs as the last person came off the floor. At that point, **an explosion occurred and fire blew into the stair well burning a firefighter who was on the steps. The firefighter was rendered unconscious and fell to the bottom of the steps.** The officer fell backwards onto the landing and was momentarily disoriented. Upon gaining orientation, he proceeded down the steps and was joined by another firefighter who assisted in dragging the unconscious firefighter out of the structure.

The cause of the explosion was later determined to be a result of the other crew operating inside the structure, who had decided to breach an interior wall in search of the fire. Fortunately, the firefighters were in full PPE, but they did experience some minor burns.

Report # 10-273

We responded to a 2-story wood frame residence with heavy fire showing at the B/C corner. The fire was extending to the 2nd floor and the attic. The initial attack line was advanced through the front door towards the B/C corner. **A secondary back-up line was positioned by the front door by the Rapid Intervention Team (RIT). The RIT was ordered by Command to advance their line to the 2nd floor. No additional RIT had been established prior to the order. While the RIT was advancing their line to the top of the stairs, the building started to shake and a loud crash was heard. Conditions in the building changed from heavy black smoke to heavy fire over our heads. We immediately directed our line towards the fire and a Mayday was called by the companies on the initial attack line downstairs.** Command ordered all companies to evacuate the building. We dropped our nozzle and followed our line back downstairs to the front door. Once we arrived at the front door we found that the ceiling in the great room had collapsed. We exited the building and gave a PAR to command. We then asked if we needed to go back in to find the companies who initiated the Mayday, only to find out that they had exited the building on the C side. A second alarm assignment was requested and we were ordered to rehab. One firefighter received second degree burns to the face.

Always Have Firefighter Rehab Services in Place at All Working Fires.

Objective: To ensure all firefighters who endured strenuous physical activity at a working fire are rehabilitated and medically evaluated for continued duty and before being released from the scene.

Narrative

Firefighting is very labor intensive and strenuous placing a high cardiovascular burden on a firefighters body. This includes excessively high pulse rates and related high blood pressures. Even in cooler climates, the core body temperatures of firefighters can rise dramatically during a firefight causing rapid loss of body fluids. Dehydration can quickly lead to heat exhaustion and the potential for heat stroke is ever present. Fluid loss and high core temperatures can be substantially higher in summer heat environments. With this excessive burden on the body the firefighter is exposed to a high risk of a cardio vascular event.

Many of the firefighter fatalities related to this physical exertion could have been prevented had the firefighter been medically evaluated while on scene, before returning to the next work cycle at the fire or before returning to the fire station. Therefore, for all working fires where firefighters engaged in strenuous physical activity the incident commander must ensure that firefighters are cooled and properly re-hydrated with fluids. Further, they must be medically evaluated by paramedics, or other qualified medical personnel, before returning to the next cycle of firefighting or released from the scene.

For a more significant or long term incident, a rehab unit or group, should be established and firefighters rotated through the unit for rehydration, cool down, and medical evaluation before returning to the next work cycle.

Those firefighters determined not fully recovered or not meeting acceptable medical parameters should be retained in rehab until recovered or transported to a medical facility for further evaluation.

There are several National Fire Protection Association standards which address the need for firefighter rehabilitation and require that rehabilitation operations **shall** be provide in accordance with fire department Standard Operating Procedures (SOP's). The standards also define the parameters for medical evaluations necessary to determine if a firefighter is fit for return to the next work cycle of firefighting or can be safely released from the scene. Applicable standards include NFPA 1500, "Standard for Fire Department Occupational Safety and Health Program" and NFPA 1561, "Standard on Emergency Services Incident Management System". Further, NFPA 1584," Rehabilitation Process for Members During Emergency Operations and Training Exercises" establishes the minimum criteria for developing and implementing a rehab process for fire department members at incident scene operations and training exercises.

Bottom line. Don't let the troops go home after a strenuous working fire without medical evaluation.

Teaching Points

- *Annually, approximately half of the Line of Duty Deaths (LODD's) experienced by firefighters is related to cardiovascular events. Most occurred on the fireground or immediately following an incident which required some level of strenuous activity.*

- *Firefighting is very labor intensive placing a high cardiovascular burden on a firefighters body. This includes excessively high pulse rates and related high blood pressures.*

- *Even in cooler climates, the core bodies temperatures of firefighters can rise dramatically during a firefight causing rapid lose of body fluids. Dehydration can quickly lead to heat exhaustion and the potential for heat stroke is ever present. Fluid loss and high core temperatures can be substantially higher in high heat environment such as summer temperatures*

- *For all working fires where firefighters engaged in strenuous physical activity the incident commander must ensure that firefighters are cooled and properly re-hydrated with fluids. Further, they must be medically evaluated by paramedics, or other qualified medical personnel, before returning to the next cycle of firefighting or release from the scene.*

- *For a more significant incident, a rehab unit or group, should be established and firefighters rotated through the unit for rehydration, cool down, and medical evaluation before return to the next work cycle.*

- *Those firefighters determined not fully recovered, or not meeting acceptable medical parameters for recovery, they should be retained in rehab. If recovery is delayed, or the firefighter is symptomatic of other medical problems (i.e. abnormal EKG), they should be transported to a medical facility for further evaluation.*

- *Several National Fire Protection Association Standards address the need for firefighter rehabilitation and require that rehabilitation operations **shall** be provide in accordance with fire department Standard Operating Procedures (SOP's). The standards also define the medical evaluations necessary to determine if a firefighter is fit for return to the next cycle of firefighting or can be safely released from the scene. Applicable standards include NFPA 1500, "Standard for Fire Department Occupational Safety and Health Program" and NFPA 1561, "Standard on Emergency Services Incident Management System". Further, NFPA 1584," Rehabilitation Process*

for Members During Emergency Operations and Training Exercises" establishes the minimum criteria for developing and implementing a rehab process for fire department members at incident scene operations and training exercises.

The NIOSH Fire Fighter Fatality Investigation and Prevention Program has identified a number of incidents in which firefighters died following strenuous physical activity during emergency operations or training exercises where rehab may not have been conducted.

Fire Fighter Suffers a Heart Attack and Dies Several Hours After Assisting at a Structure Fire – Illinois

http://www.cdc.gov/niosh/fire/pdfs/face200713.pdf

On July 29, 2006, a 43-year-old male paid/call Fire Fighter (FF) responded to a residential fire at 1917 hours. The fire occurred on a very hot (81 degrees Fahrenheit [°F]) and humid (77% relative humidity) evening. On-scene, the FF assisted in stretching the booster hose from the engine and setting up a positive pressure ventilation fan. During fire suppression operations, the FF and two other crew members had symptoms consistent with heat strain. About 2 hours later, units returned to their fire station, and the FF returned home for the evening. Crew members called the FF at about 2130 hours to check on him, and he stated that he was feeling better. About an hour later, a crew member called the FF again, but this time the FF did not answer the telephone. The crew member asked his spouse to drive over to the FF's house and check to make sure he was alright. After ringing the doorbell and not getting any response, she entered the house and found the FF collapsed on the floor. She called 911 and began cardiopulmonary resuscitation (CPR). An ambulance arrived at his home 14 minutes later. Paramedics attached a cardiac monitor which revealed asystole (no heart beat). The coroner was notified and pronounced the FF dead via telephone. The NIOSH report included recommendations that fire departments institute incident scene rehabilitation (rehab) during extensive structural fires, to perform pre-placement and periodic medical evaluations consistent with National Fire Protection Association *(NFPA) 1582, Standard on Comprehensive Occupational Medical Program for Fire Departments*, and to develop a structured wellness/fitness program for fire fighters to reduce risk factors for cardiovascular disease and improve cardiovascular capacity.

Fire Fighter Suffers Sudden Cardiac Death During Live Fire Training – North Carolina

http://www.cdc.gov/niosh/fire/pdfs/face200836.pdf

On June 6, 2008, a 50-year-old male volunteer fire fighter (FF) taught a morning class that consisted of fire suppression topics and personal protective equipment use at the fire training center of a local community college. After lunch, in stressful environmental conditions (i.e., high temperature and high humidity), he stretched 100 feet of uncharged 1½-inch hoseline and prepared the fire engine for the live fire training session. He then led an interior search team during the smoke exercise in the burn building while wearing full bunker gear and his self-contained breathing apparatus (SCBA) on air. After exiting the building and taking a 15-minute break, the FF led the portable fire extinguisher evolution. About halfway through the exercise, the FF complained of not feeling well and took a break in the air-conditioned cab of the fire engine. While the students were performing the next evolution (hose training), the FF remained at the engine and monitored apparatus operation. The FF cancelled the next exercise, the burn box, due to the heat and his not feeling well, but another instructor volunteered to lead this evolution. The FF agreed and stayed with the engine. The training ended at approximately 1530 hours. Shortly after refilling the engine's water tank, the FF collapsed. Despite cardiopulmonary resuscitation (CPR) and advanced life support delivered on scene, in the ambulance, and in the hospital's emergency department, the FF died. The NIOSH report recommendations included the need to formulate and institute a heat stress program and a rehabilitation (rehab) program in accordance with NFPA 1584, Standard on the Rehabilitation Process for Members During Emergency Operations and Training Exercises, and the need to provide on-scene emergency medical service with advanced life support capability during live fire training.

Paid On Call Fire Fighter Suffers a Fatal Cardiac Event Just After Completing Two Hose Training Drills – Wisconsin

http://www.cdc.gov/niosh/fire/pdfs/face200819.pdf

On June 12, 2007, a 42-year-old paid on-call Fire Fighter (FF) participated in mandatory Fire Department training. The training involved hose drills consisting of making a hydrant connection, advancing an attack hose line, and utilizing the nozzle. The FF participated in two drills, each lasting about 5 to 10 minutes. There was a 15 minute "cool-down" period between drills during which time the FF removed his personal protective equipment, drank cool fluids, and helped reload the hose. Following a 15-20 minute break to discuss the goals of the training, the FF collapsed. Despite on scene cardiopulmonary resuscitation (CPR) and defibrillation, continued CPR in the ambulance, and advanced cardiac life support in the hospital Emergency Department, the FF could not be revived. The NIOSH investigator considered that the physical effort associated with the hose drills performed during training in full personal protective equipment triggered a probable heart attack and the subsequent sudden cardiac death of this FF. The NIOSH report recommendations included the need to provide mandatory pre-placement and periodic medical evaluations of fire fighters consistent with the National Fire Protection Association (NFPA) Standard 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments* and the need to ensure that incident scene rehabilitation is established for working fires and training evolutions.

Appendix A

Survivability Profiling: How Long Can Victims Survive in a Fire?

Jul 1, 2010

BY STEPHEN MARSAR

In 2007, the United States suffered 118 firefighter line-of-duty-deaths (LODDs), 47 of which occurred in structure fires; two civilians were killed in those same fires. In 2008, there were 114 LODDs; 31 occurred in structural fires; three civilians were killed. In 2009, there were 89 LODDs, 24 in structural fires, and zero civilians were killed in those same fires.[1]

In my article "Survivability Profiling: Are the Victims Savable?" (*Fire Engineering*, December 2009), I defined survivability profiling as the art of examining a situation and making an intelligent and informed decision based on known events, or circumstances, to determine if civilians can survive existing fire and smoke conditions and to determine whether to commit firefighters to life-saving and interior operations. Based on the likelihood of civilian survivability, this concept goes beyond the tendency to justify risk whenever we respond to an occupied structure fire.

Survivability profiling asks—if people are suspected or known to be trapped—is there a reasonable assumption that they may still be alive? If not, we should slow down and attack the fire first and complete the searches when it is relatively safe for our operating forces to do so. Some will argue that using survivability profiling will kill people. No, fires and smoke kill people (many times before we even arrive on the scene). Survivability profiling *will* save firefighters' lives.

The National Fire Protection Association (NFPA) states that the upper limit of human temperature tenability is 212°F, well below temperatures found in most significant structure fires that are beyond the growth (incipient) stage. In today's fire environments, temperatures higher than 500°F can be easily obtained within three to four minutes. Flashover, which occurs at approximately 1,100°F, can develop well under five minutes.[2] If a space isn't tenable for firefighters, trapped victims aren't likely to survive either. Take the time to make it safe and prevent your firefighters from taking unnecessary risks.

Scientific research on human respiratory burns[3] and inhalation of hot gases in the early stages of fire[4] reveals that occupants trapped in structural fires have limited survival times. In the first

experiment, which lasted 11 years, fire victims were tracked if they met three diagnosed criteria: (1) flame burns involving the face, particularly the mouth and nose; (2) singed nasal mucus membranes; and (3) burns sustained in closed-space, interior fires.

Twenty-seven patients were treated; 11 additional patients didn't meet all three of the test criteria or were dead on arrival. Of the 27 patients whose body surface burns ranged from 15 percent to 98 percent, 24 died (three in the first 24 hours and five within 36 hours). Respiratory burns directly accounted for 18 of those deaths (the others died of other burn injury complications). Factors that affected the fatalities included heat, toxic smoke, and humidity. (3)

Sixty percent of the victims were found to have been exposed to heat (most at temperatures above 200°F; some were below) and humidity for six to seven minutes (remote from the fire area). The fatality rate increased to 90 percent for those exposed to toxic smoke as well, even for only several minutes. The experiment concluded that human fire victims were most susceptible to respiratory burns from heat first, toxic smoke second, and humidity a distant third (victims found remote from the fire area died of smoke first and heat second, with heavy smoke conditions leading to immediate respiratory burn injuries). The time of exposure for all 24 fatalities was less than 10 minutes. (3)

The second experiment (using laboratory mice and human fire victims) (4) assessed the impact of inhaling hot gases during the early stages of fires. The researchers concluded: "Thermal injury takes place quickly," with death occurring at temperatures of 350°F within three minutes. The experiment notes that fire temperatures rise to more than 1,200°F within five minutes; therefore, the survival outcomes for victims are further limited. (4)

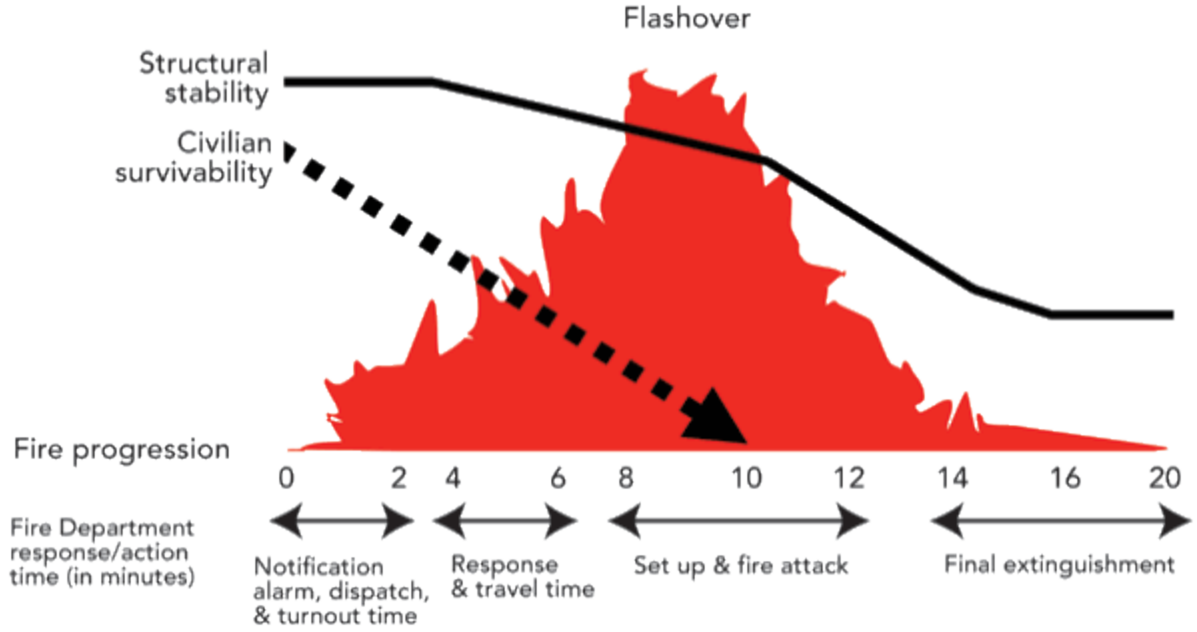
Lethal first-degree respiratory burns were found to occur in just 230 seconds (under four minutes). The experiment concluded that facing the fire causes more serious damage to the human respiratory tract, especially if the subject could not get away from the immediate fire area. It found that decreasing air velocity while increasing respiratory rates was helpful in minimizing thermal injuries of the respiratory tract. However, the experiment acknowledges that educating the public on this particular finding, coupled with the psychological and physiological reactions of civilians in fire situations, probably makes this conclusion unrealistic in helping to save lives.

The clinicians found that it would be helpful to know the time that the patient was subjected to fire and smoke, along with the approximate temperatures encountered. This might be helpful in establishing an appropriate treatment protocol. Providing this information for firefighters may prove difficult to impossible, but perhaps noting the victim's location in relation to the proximity of the fire would be helpful.

Based on the work of Klaene and Sanders,[5] from a size-up point of view, you must carefully consider the potential benefit to life and property vs. the risk to firefighters, as the risks generally increase with time. The benefit to civilian occupants tends to decrease exponentially with time unless the fire is controlled quickly. As the probability of saving lives and property decreases, the degree of acceptable risk should also decrease.

Figure 1 illustrates how fire progresses from ignition through flashover. It shows flashover occurring in between two and six minutes. This is just as firefighters may be arriving on scene and entering the fire area. The structural stability and survivability lines in the illustration each start at 100 percent, when the building is at its maximum strength and occupants have the best chance of escape. As the civilian survivability timeline moves toward the horizontal axis, the chance of survival nears zero, as the fire and deadly smoke conditions increase. At the same time, the structure is continuously losing strength and is proceeding toward catastrophic collapse.

Figure 1. Fire Progression, Structural Stability, and Survivability Comparison



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Of course, no two fires act the same or follow an exact timeline. Some fires may progress more slowly, and some may grow more quickly, depending on many factors and conditions. (2)

According to the Phoenix (AZ) Fire Department's "Safety and Risk Management Profiles"[6] standard operating procedure, when considering the "SURVIVAL" of any victim in any emergency, members must consider the conditions that are present in the "compartment or area," or the fire and/or hazardous atmospheric conditions affecting the victim's viability. As examples, the procedure includes the following:

A fire in a rear bedroom of a house, with smoke throughout the house, may allow a survivable environment if a search and rescue effort is initiated quickly. We may extend risk, in a calculated manner, in these conditions. A significant fire in a residence with dense smoke under pressure to floor level throughout the building likely means victims could not survive. A very cautious, calculated rescue and fire control operation would be warranted. A well-involved building would likely represent a zero survivability profile. Similar conditions in an abandoned building would indicate little survivability and little property to be saved. Members should avoid an offensive firefight. Victims buried by a trench collapse or under water for 10 minutes or more would be

unlikely to survive; therefore, an extremely cautious and well-planned, safe recovery operation is required.

The key to the concept of survivability profiling is for firefighters to stop for a few seconds, get the big picture of the incident they are facing, gather as much information as possible, and make an educated decision as to the probability (*not* possibility) of victim survival. As posed by Gary Klein,[7] "Firefighters should rely on their intuition and gut feelings to assist them in making these most difficult of decisions. What might be the hardest decision for a firefighter to make is to not enter a burning structure or hazardous area where people might or even are known to be trapped without the possibility of survival."

Focusing on the civilian survivability timeline as shown in Table 1, you must examine the relationship of oxygen levels for both humans and the fire. According to the New York State Office of Fire Prevention and Control, "The human body and fire are similar in that they both require oxygen to survive. Fire, for example, consumes oxygen and produces toxic gases that may displace, absorb, or dilute the remaining available oxygen. At 16- to 17-percent oxygen levels, a fire will start to die out or smother due to oxygen deprivation. Atmospheres below 19.5 percent are considered oxygen-deficient atmospheres."[8]

Table 1. Effects of Hypoxia[8] (Reduced Oxygen)

Oxygen Percentage Available	Symptoms
21	Normal conditions, no effect.
19.5	OSHA oxygen-deficient atmosphere.
17	Muscular impairment, rapid breaths.
12	Dizziness, headache, rapid fatigue.
9	Unconsciousness.
7 to 6	Death within a few minutes.

Table 1 also shows the effect of decreased oxygen on the human body—that is, below 19.5 percent, the human body, particularly the brain, will start to feel the effects. Below 16 to 17 percent, physical and emotional impairments will be exhibited, and below 9 to 10 percent, unconsciousness and eventually death will occur. These low oxygen levels do not include the toxic by-products found in smoke during a fire.

When the by-products of fire—that is, smoke and toxic gases—are added to the oxygen-deficient atmospheres found in most enclosed structure fires, you can readily identify the harmful effects and the speed at which they can incapacitate and kill humans. These toxic by-products and oxygen-deficient atmospheres have been well documented and extensively researched. One example of this documentation is the article "CO Rx: A Safety Prescription," which chronicles the near-death experience of one Fire Department of New York fire officer and the tragic deaths of 10 others over the past 30 years.[9] Each of those deaths resulted from carbon monoxide (CO) poisoning.

The article states: "More fire deaths occur from CO poisoning than from any other toxic product of combustion." It demonstrates the speed with which CO can incapacitate an individual (within minutes). It also describes CO as "an odorless, colorless, tasteless, and non-irritating gas that is present in all fires ... it is an extremely flammable gas that can travel great distances." CO crowds out oxygen from the blood, poisoning the brain and tissues. Several factors that can lead to CO poisoning include (1) the level of CO in an area, (2) the length of time exposed, and (3) the physical condition and activity of the individual during the exposure.

The cumulative effects of CO and the bonding of CO to the blood's hemoglobin (known scientifically as COHb) have a "half-life of about five hours." That means that it will take approximately five hours for COHb in a human's body to drop to half of its current level after the CO exposure has ended. (9)

Carbon monoxide effects are first felt by the parts of the body with high metabolic rates, with the brain and heart being the most sensitive. Firefighters who are hard at work during a fire will be more susceptible than a more sedentary, unconscious, or moderately active person. The inability to control muscle movements is a symptom of severe exposure and is quickly followed by unconsciousness. Tables 2 and 3 show how the percentage of COHb affects humans. The letter "K" represents "a factor related to exertion level." The value of K = 3 for resting or an unconscious state, = 8 for moderate exertion, and = 11 for strenuous exertion. (9)

Table 2. COHb Levels and Effects[2]

COHb	Symptoms and Medical Consequences
10%	No symptoms.
15%	Mild headache.
25%	Nausea and serious headache.
30%	Symptoms intensify.
45%	Unconsciousness.
50%	Death.

Table 3. Comparing Similar Exposures Under Rest and Exertion[9]

COHb	CO ppm*	CO% in air	K factor	Exposure time
45%	200,000 ppm	20%	3	45 seconds
45%	200,000 ppm	20%	8	16.9 seconds
45%	200,000 ppm	20%	11	12.3 seconds

At rest, it would take 45 seconds to develop 45% COHb levels; strenuous exertion reduces this time to 12.3 seconds. At 45% COHB, a person is unconscious. **A firefighter will not have time to react.** Note. * ppm = parts per million in air

Table 4 shows the human response to CO at different concentrations.

Table 4. Human Response to Carbon Monoxide at Different Concentrations[2]

Carbon Monoxide (CO) in Air	Human Response
0.2 %	Headache after 10 minutes, collapse after 20 minutes, and death after 45 minutes.
0.3 %	Maximum "safe" exposure for five minutes and danger of collapse in 10 minutes.
0.6 %	Headache and dizziness in 1 to 2 minutes and danger of death in 10 to 15 minutes.
1.28 %	Immediate effect, unconsciousness after 2 to 3 breaths and danger of death in 1 to 3 minutes.

CYANIDE

In a more recent study, the People's Burn Foundation[10] expands on the above CO information by citing a 2006 NFPA study that reveals 87 percent of people who died in fires had a toxic blood concentration of cyanide as well as CO.

As the president of the Cyanide Poisoning Treatment Coalition, Robert Schnepp, an assistant chief in the Alameda County (CA) Fire Department, laments: [These findings are] "critical to firefighters, as researchers are now finding that job-related deaths once thought to be related to lack of oxygen, over-exertion, or heart attack in some cases can instead be directly linked back to cyanide poisoning." (10) He further states that "these victims died from breathing the smoke long before the fire killed them." (10) Items in the home that are burning and being heated will give off deadly poisonous and toxic gases. According to the Macomb (MI) Fire Department's public education flyer, these gases will confuse and disorient people still in the home, making the simplest task (and hence, escape) seem difficult to impossible. Very quickly, smoke will obscure the lights and the daylight coming through the windows. Rooms will become black. The heat will be unbearable. The combination of poisonous gases and smoke will be choking, blinding, and lethal.

The flyer answers a common question from civilians: "How much time do I have to escape a fire?" The answer: "To survive a fire in your home, you must act immediately; your time is measured in seconds—not minutes."

In the*Toxic Twins* video presentation, (10) Schnepp contends: "Today fires burn hotter, grow faster, and are more toxic than fires of the past," as we all know.

When ignited, one pound of wood releases 8,000 British thermal units (Btus). A Btu is defined as the scientific measurement of the amount of heat required to raise one pound of water 1°F. Conversely, one pound of plastic from today's environment has been shown to release as much as 19,900 Btus when it is ignited. Household items once made out of wood are now fashioned out of plastics. The toxic smoke produced by the proliferation of synthetic materials and the extreme temperatures reached in very short duration has high levels of hydrogen cyanide that is 30 times deadlier than that of CO alone. That can lead to chronic health hazards with accumulative effects. The effects of cyanide and CO together have been named "The Toxic Twins." (10)

According to Schnepp, cyanide disables the body's ability to absorb oxygen. The human body has an affinity for CO approximately 250 times to one compared with oxygen. Cells begin to die, and the body's ability to function and move is quickly impaired. Cyanide impairs the human's ability to think and move. Schnepp uses the analogy: "Cyanide kills your organs, CO kills your blood, and it only takes a matter of seconds." At a relatively low concentration of 135 parts per million (ppm), cyanide and CO will kill a person in approximately 30 minutes. At 3,400 ppm (as is found in most enclosed structure fires), survival time is cut to less than one minute.

Brian A. Crawford, chief of the Shreveport (LA) Fire Department, has examined and introduced the "Firefighter Duty to Die Syndrome (FDTDS)." He examines the relationship between line-of-duty fatalities and the psychological factors that create a cultural belief that dying in the line of duty is part of the job. Crawford, acknowledging that firefighting is inherently dangerous,

admits that some firefighters will die despite every precaution, safe workplace practices, and healthful lifestyle changes meant to minimize such risks. However, looking at the U.S. average of 100 LODDs annually, he feels the fire service must begin to look beyond the traditional explanations and practical recommendations.

The fire service "must expand discussions to more aptly include psychological components such as those found in the FDTDS," Crawford says. Without serious discussion as to why some fire department cultures, groups, or individuals believe that unnecessary risk and unsafe behaviors are an acceptable part of the occupation, "the fire service is missing the mark and possibly a chance to save the life of one or more of its own," he explains.

As Crawford sees it, the syndrome is a "firefighter's behavior that reflects a sense of obligation and duty to unnecessarily risk personal and others' safety above what is appropriate or required." The problem of FDTDS comes, he notes, when firefighters venture beyond safe limits and escape unhurt. This increases their belief that since the behavior did not result in an injury, it must be acceptable. Crawford further examines how firefighters who undertake unsafe actions often rely on the ends to justify the means and often feel that the dangers of their actions are irrelevant if a victim (dead or alive) is rescued or recovered and the fire is extinguished, "even if performing the task in a safer manner would have produced the same result."

Sooner or later, according to Crawford, the end will not justify the means, as when a firefighter is seriously injured or killed. "The odds of tragedy are increased by the syndrome's snowballing effect," he says. If a firefighter is allowed to perform dangerous actions without consequence or, worse, the actions are met with praise, the chances are increased that the behavior will be repeated until a negative result ultimately occurs. Regarding the investigations into LODDs, Crawford suggests that the mental developments that led the firefighter to being in that tragic place at that tragic time should be the focus of reducing deaths and "not a sidebar." Crawford notes that currently, national firefighter fatality investigations, discussions, and recommendations all focus on practical actions, policy, and procedures and all but ignore the "cognitive processes leading up to and occurring during line-of-duty incidents."

The bottom line is that there is a challenge before the firefighters in the United States. That challenge is to develop a culture and attitude that do not accept LODDs as part of the job. Risking lives to save others is a noble calling. It must be done in a calculating manner and as safely as possible within the hostile environments in which we are forced to work. Survivability profiling and the recognition of the very limited time that occupants have to survive, dependent on the fire and smoke conditions found, *must* be a conscious thought in our minds. With national average response times of four to six minutes—in some instances, when there *are* civilians trapped—we may have only an additional two to four minutes to search, locate, remove, and revive them. These are facts, not conjecture.

Will we be able to look in the faces of parents on the front lawn of their burning home and tell them that their loved ones inside are not savable? I don't know. But, what I *do* know is that if survivability profiling is telling us that, in reality, their loved ones are not savable, we hopefully have learned to put out the fire first and perform the searches as quickly as possible when it is

relatively safe to do so. We will be doing "everything we can," including saving the lives of firefighters.

Endnotes

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Survivability Profiling: Are the Victims Savable?

Dec 1, 2009

BY STEPHEN MARSAR

This is it—the one we all think about, the one we train for every day but hope never happens: Your department is called out in the early morning for a structure fire. While you are responding, the dispatcher gives you additional information, "Multiple calls with trapped occupants." You are first on-scene and confirm what you knew in the pit of your stomach to be a reality: On the front lawn, a woman in her nightgown is screaming frantically that her husband and two children are still "in there."

How many of you have already decided to don your personal protective equipment and enter the structure or commit your crew to doing so? I'll bet my career that most, if not all, of you have. There may be a minority of you who were unable to make that same decision because important information is lacking: Where is the fire located? Are flames coming out of every door, window, and crack in the structure? What is the smoke condition, and what is it telling us? What is the construction/stability of this building? Is it a private dwelling? A condominium with lightweight construction? Or is it a fire resistive occupancy? Is a rapid intervention team (RIT) in place, and are enough firefighters on-scene to mount an attack? After answering these questions, then and only then can you conclude the probable (vs. possible) survivability of any trapped victims that may be inside. Yet, most of you were willing to run in based on the initial information provided, right?

SURVIVABILITY PROFILE

Today, although rapid intervention teams are commonplace and despite all our technological advances, national firefighter line-of-duty deaths are not decreasing. Since 1977, the national average of firefighter fatalities has been approximately 100 annually, with 114 occurring in 2008. Of the firefighter fatalities in 2008, 31 (or 27.1 percent) occurred in structural fires.[1] Perhaps the time has passed when we should have left 31 vacant lots and gone home to our families instead.

We can and must conduct a realistic survivability profile of trapped victims using proper size-up.[2] We must acknowledge that, in some instances, the chances of survival for the occupants are no longer and that rescue has turned into a recovery. We need to recognize and accept this reality when it is presented and before we commit firefighters, thus using survivability profiling.

Risk vs. reward analysis and survivability profiling must go hand-in-hand. The National Fire Academy (NFA) risk vs. reward analysis model is simple: "Risk a lot to save a lot, risk a little to save a little, risk nothing to save nothing." We should all adopt it.

Deputy Chief Todd LeDuc of Broward Sheriff Fire Rescue in Ft. Lauderdale, Florida, points out, "Don't mistake risk for chance!"[3] He acknowledges that incident commanders (ICs) may take acceptable risks, especially when trapped occupants or firefighters are at stake. "However, to forgo risk assessment [and survivability profiling] and leave the results to chance should raise the big red flag of unacceptable risk and behavior," he adds.

Perhaps no one knows that better than District Chief Mike McNamee of the Worcester (MA) Fire Department who, on the night of December 3, 1999, courageously made the decision to stop firefighters from entering a cold storage warehouse fire to search a building that had already claimed (at that time) the lives of four firefighters. Although two additional firefighters were ultimately lost during that tragic event, the risk assessment McNamee performed certainly saved the lives of at least a dozen more. He used survivability profiling in the harshest sense. He knew that after losing radio contact and being out of air for more than 15 minutes in a windowless and fully engulfed building, the missing firefighters were beyond rescue. He boldly decided to cut the department's losses and not risk the lives of the remaining firefighters who so bravely and readily were willing to go back in to search for their brothers.

Understandably, we in the fire and emergency services always give victims and patients the benefit of the doubt. We save hundreds of fire victims every year because of our notion that someone could "possibly" be trapped. It is also well documented that our perception of "probable" life hazard (based on the time of the fire and occupancy type) has led us to feats of superhuman effort to locate and save those who could not assist in their own removal. Conversely, our automatic assumption as to "possible" and even "probable" life hazards has also led to firefighter fatalities in structures where no civilian life hazard existed.

The number of civilian fatalities that occur annually in the same incidents as firefighter fatalities appears to be disproportionate. According to the National Fallen Firefighters Foundation (NFFF), "Firefighters are doing a better job at preventing civilian deaths than they are at protecting their own lives." For example, during my 19-plus-year career as a member of the Fire Department of New York (FDNY), there have been 32 firefighter fatalities from being caught or trapped in structural fires to date (not including the 343 members killed on September 11, 2001, and seven other members who died in that same timeframe in other circumstances). The immensely sobering fact in each of those tragic fires is that *not one* civilian fatality occurred! As another example, in 2005 the *Boston Globe* examined the federal investigative reports of 52 fires that killed 80 firefighters between 1997 and 2004. In only 14 of those 52 fires was there even a suspicion of trapped occupants. In only six of those 52 fires were people in the building at the time of the fire department's arrival and, once again, not one of the 52 fires resulted in a civilian fatality.

Admittedly, the unfair and often undocumented flip side of the above statistics is that many civilians were safely rescued or evacuated prior to or following the events that led to the firefighter fatalities. Unfortunately, among the United States Fire Administration (USFA), the

National Fire Protection Association (NFPA), the Federal Emergency Management Agency (FEMA), the National Fire Incident Reporting System (NFIRS), and the National Institute for Occupational Safety and Health (NIOSH), no such statistical data are recorded or required. In an effort to start gathering such information (saved victims), FDNY has recently begun collecting such data as part of its NFIRS reporting.

The USFA, through the NFA and the NFFF's Firefighter Life Safety Initiatives, has set goals to reduce firefighter fatalities by 25 percent within five years and by 50 percent within 10 years. To assist in obtaining those worthy goals, the NFFF has published the "16 Firefighter Life Safety Initiatives" as a blueprint for fire service change.[4]

Looking at firefighter fatality statistics, we see the same reoccurring issues: heart attack, no seat belts, vehicle crashes, disorientation, structural collapse, and burns. Although some items on the list are less preventable than others, the majority of them are preventable, according to the NFFF.

Another consideration in survivability profiling is the aggressive interior attack—sending firefighters into buildings where civilian survivability is very small or nonexistent. It is used a great deal by many progressive departments and, according to FDNY Deputy Chief (Ret.) Vincent Dunn, is successful 95 percent of the time if the fire is extinguished quickly before flashover occurs. This strategy also puts firefighters in vulnerable positions in and around the fire area before a hoseline is in place and before the fire has been darkened down. The result may be cut-off and trapped firefighters.

I have always believed that the words "an aggressive interior attack" should be removed from standard operating procedures (SOPs) and replaced with the phrase "an intelligent and coordinated fire attack," not always aggressive and not always interior. The SOP of the forward-thinking Fulton County (GA) Fire Department says: "Though the mission of the fire department involves response to emergency incidents, the preservation of life (including those of Fire Department members) is paramount .... No property is worth the life of a member of the Fire Department." It continues: "Fire Department members shall NOT be committed to interior firefighting operations in any structure that is obviously abandoned, derelict, known or reasonably believed to be unoccupied." Bravo! As a national service, we should take a close look at the present "aggressive attack strategy" (especially in understaffed departments); it is killing us—literally.

I am in no way saying that "surround and drown" operations should become our bread-and-butter operations—quite the contrary. What I am saying is that we need to slow down. We need to stop, look, and think before we run into burning buildings blindly, assuming that there's a life to be saved every time.

Ed Fletcher, Executive Fire Officer Program instructor at the NFA, adds: "If it's predictable, it's preventable; and if it's preventable, then it wasn't an accident." We owe it to ourselves, our families, and those we serve to stop repeating history and to lower the number of firefighter line-of-duty deaths.

Survivability profiling is the educated art of examining a situation and making an intelligent decision of whether to commit firefighters to life saving and/or interior operations. It differs from basic risk vs. reward in that it goes beyond the tendency to justify risk whenever we respond to an occupied building.

As firefighters, our knowledge of fire behavior, fire spread, smoke conditions, smoke movement, and building construction as well as individual experience level play vital roles in profiling the survivability of known or reported trapped occupants. Therefore, the first step in survivability profiling must be to STOP. Stop and consider your normal size-up points and risk vs. reward idiom in addition to the realistic sustainment of life. If paramedics and EMTs can pronounce death based on given signs and symptoms (or lack thereof), can't firefighters do the same with survivability profiling?

THE KEOKUK TRAGEDY

In a real-life scenario eerily similar to the one at the beginning of this article, on December 22, 1999, at 0824 hours in Keokuk, Iowa, three firefighters and the three children they were trying to save died in a house fire. When the town's four available career firefighters arrived at the scene, a woman was out front, covered in soot and yelling, "My babies are inside." Apparently, the plastic trays from her 22-month-old twins' high chairs were left on the stove, and a four-year-old sibling turned on a burner. After the three firefighters recovered the lifeless twins (who were never revived) and attempted to exit with the third unconscious child, a flashover occurred instantly, killing the firefighters. "Even in that situation, despite their instinct to save lives, the firefighters should not have gone into that house. The children were probably already dead," said Keokuk Chief Mark Wessel.[5] The official NFPA report on the fire found the contributing factors in the firefighter fatalities to be (1) lack of proper building/incident size-up (risk vs. reward/survivability profiling), (2) lack of a proper incident command system, (3) lack of an accountability system, (4) insufficient resources to mount suppression and rescue activities, (5) lack of a RIT, and (6) lack of SOPs requiring a RIT.

Using survivability profiling, the Keokuk firefighters may have realized what their chief had said: Because of the amount and volume of smoke, the advanced stages of fire progression on arrival, and the limited resources to conduct simultaneous attack and search and rescue, victim survivability was extremely unlikely. Keokuk's Wessel continued: "Did they do what any red-blooded American firefighter would do? Yes, they did." The lessons learned that day, according to Wessel, were '' ... what you need to do is slow down your operation. We should have focused more on the hose, less on the mother screaming ...."[6]

Although a neighbor is standing on the front lawn telling you there are (or may be) people inside a structure, do you ever stop to ask them how they know that there are people inside? And if by chance they say they do indeed know there are people inside, do you ask them where the people were last seen or where they would be expected to be found? Logical follow-up questions

(although unreliable at best) might be, How long has the fire been burning? and Where is the fire located?

At a recent basement fire in a private dwelling, the homeowner notified the first-arriving chief officer that everyone was out of the house and accounted for. The first search and hoseline teams entered the front door in a heavy smoke/medium heat condition to search for the stairs to the basement, with no luck. After several minutes, the IC ordered an attack through the rear yard basement door. As that attack commenced, the first team found a narrow circular staircase leading from the first floor to the basement and attempted to descend it. The attack from the exterior door was halted while a dangerous and time-consuming attack down the circular stair was attempted (and subsequently aborted).

My question to the first-arriving chief officer was, Why didn't you ask the homeowner where the location of the basement stair was before commencing the initial attack? The answer? No answer! Had those first search and hoseline teams become trapped on or at the bottom of the circular stairs, it would have proven difficult for them to self-extricate or to be rescued. Remember, the homeowner told us everyone was out!

In February 2009, NIOSH released the report "Preventing Deaths and Injuries of Fire Fighters When Fighting Fires in Unoccupied Structures." The report contends that firefighters may not fully consider information related to building occupants or their likelihood of survival before performing offensive (aggressive) interior operations. It cites numerous cases in which fire crews entered and remained in high-risk fire situations when it was known that no occupants could be rescued or even were present. The report concludes with "the top priority at all fire scenes should be saving and preserving lives—both civilian and the firefighters at the scene." (6)

Using survivability profiling at structure fires, we perform a six-sided size-up (yes, that includes above and below the fire area and its four sides). What is the condition/construction of the structure? What is the fire condition? What color and under what pressure is the visible smoke/flame? In what areas should we concentrate our initial attack and searches? How can we safely access the areas to be searched? Do we have sufficient resources on-scene to start operations and have a rescue team in place?

Survivability profiling asks—if persons are suspected or known to be trapped—is there a reasonable assumption that they may still be alive? If not, we should attack the fire and complete the searches when it is relatively safe for our operating forces to do so.

Survivability profiling is an added tool in our risk vs. reward analysis. Use both in conjunction with proper size-up to help reduce firefighter fatalities.

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Survivability Profiling Takes Size-Up to a New Level

Firefighters must consider not just whether victims might be inside, but whether they can still be alive

By Stephen Marsar

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You might be looking at the title of this article thinking, "Not another opinion piece with a catchy buzzword!" Actually, "survivability profiling" is not an opinion—or even a buzzword; it's a concept. And it's not an easy one—with a 20-plus year career as an interior structural firefighter, even *I'm* not 100% comfortable with the concept. However, the facts speak for themselves. And why should we—you—care? Because it's the emerging leaders of the fire service who will be required to make educated, informed and safe decisions on the fireground, as they're the ones who may be held accountable when a firefighter under their command is injured or killed in the line of duty.

What Is Survivability Profiling?

Over the past five years, 120 U.S. firefighters have been killed in the line of duty at structural fires. This figure does not include auto accidents, heart attacks, strokes, etc.—it only includes firefighter fatalities that occurred during direct fire suppression activities. Only *six* civilians were killed in those same structural fires that took 120 firefighter lives. This dichotomy is the focus of survivability profiling.

Survivability profiling is defined as *the art of making an educated and informed decision, based on known events or circumstances, to determine if civilians can survive the existing fire and smoke conditions inside burning structures*. No action plan can be accurately developed until we first determine if the victims can survive the fire and toxic smoke conditions before rescuers search for and locate them, remove them and attempt to revive them.

I first developed the concept of survivability profiling in 2009 while attending the Executive Fire Officer Program; you can view the complete research project at www.usfa.fema.gov/pdf/efop/efo44310.pdf. That project received validation when it was cited in the NIOSH report on the line-of-duty death (LODD) of Firefighter Brian Carey in Homewood, Ill. (www.cdc.gov/niosh/fire/reports/face201010.html).

The springboard for survivability profiling stemmed from the fact that in the 19 years I'd been with the FDNY at the time, 32 LODDs had occurred during structure fires—yet *not one* civilian was killed in any of those fires. It should also be noted that each of those 32 firefighters was performing fire suppression operations (e.g., primary searches, overhaul, checking for extension and/or initial fire attack).

Other studies back up this trend. In 2005, *The Boston Globe* investigated the federal reports of 52 fires that killed 80 firefighters between 1997 and 2004. Each firefighter died fighting building fires. Although the article cited contributing factors in the fatalities, such as reduced firefighter staffing and inadequate response times, more startling facts were presented. In only 14 of those 52 fires was there even a suspicion that someone might be inside. In only six of those 52 fires were people in the building at the time of the fire department's arrival, and, once again, *not one* of the 52 fires resulted in a civilian fatality.[1]

So, what makes survivability profiling different? Well, the difference is that it goes beyond our traditional size-up criteria and the mindset that there's a life inside every burning structure that we respond to. Although there have certainly been civilians saved by this thinking, the sobering fact is that this assumption has also killed many firefighters. The research supports the fact that in many fires where firefighters have been killed, *we*, after entering the structure, were the only life hazard that existed. Conversely, even in situations where we know or are reasonably certain that civilian lives are inside a burning structure, we must *sometimes* look at the fire and smoke conditions and conclude that some trapped occupants are just not savable. This extremely difficult and unpopular decision will require us to attack the fire first and conduct search and/or rescue, and/or body recovery, when it's relatively safe for our operating forces to do so.

The Need for Cultural Change

So, does that mean we should just *surround and drown* all structure fires that we respond to? Of course not, nor does it mean that we should stop interior firefighting operations. It means that we must slow down and rethink the way we do business in certain situations, especially in understaffed departments—an issue that many emerging leaders are dealing with as a result of budgetary cutbacks and political restraints.

We need to be more honest with ourselves and professional enough to reach educated conclusions regarding civilian survivability at *some* structure fires. That is why the IAFC's Rules of Engagement for Structural Firefighting have been adopted on a national level. They provide guidelines on go/no-go decision-making and firefighter safety and survival.[2]

It appears that our past size-up techniques just do not go far enough. Brian Crawford (chief of the Shreveport, La., Fire Department) has written about the "Firefighter Duty to Die Syndrome (FDTDS).[3] Chief Crawford examines the relationship between LODDs and the psychological factors that create a cultural belief that dying in the line of duty is part of the job. He defines FDTDS as "a firefighter's behavior that reflects a sense of obligation and duty to unnecessarily risk personal and others' safety above what is appropriate or required." Without serious discussion as to why some fire department cultures, groups or individuals believe that unnecessary risk and unsafe behaviors are an acceptable part of the occupation, Chief Crawford believes that the fire service is missing the mark and possibly a chance to save the life of one or more of its own.

Put simply: The U.S. fire service and its emerging leaders must develop an attitude that does not accept LODDs as part of our profession. This is a common theme throughout the UK fire service, where they recently held rallies in protest after the first LODD in eight years. In Asian fire services, an LODD is recognized as a failure of the system and is intensely scrutinized.

Survival Times

To effectively implement survivability profiling, firefighters and officers must understand how long people can survive within fires. Two studies give factual insight into the concept: "Respiratory Burns: A correlation of clinical and laboratory results"[4] and "Theoretical evaluation of burns to the human respiratory tract due to inhalation of hot gases in the early stages of fire."[5]

Individually (and 38 years apart), these studies concluded that civilian survival times in fire conditions are limited to approximately 10 minutes. These estimations were generated based on the studying of human fire victims and laboratory mice exposed to heat and toxic smoke environments. Neither of these studies have been disputed or replicated since their publication.

As part of my research, I also consulted several city and county medical examiners and fire marshal offices throughout the country. From them I learned that estimating the times of death for civilian fire victims can be extremely accurate. It takes into consideration evidentiary information such as discovery of the fire, receipt of the initial call, fire department dispatch and response times, the time the victim was found, the victim's location and physical body position, and the time the fire was brought under control. This same practice has been routinely utilized in homicide investigations for decades.

Take It to the Next Level

Risking our lives to save others is certainly a noble calling. Thousands of lives are saved every year in this country because firefighters are willing to risk it all. *Calculating* that risk is where we need improvement. Survivability profiling is not much different from our traditional size-up. However, it takes basic size-up to the next level.

Traditional size-up asks, "Are there people in there?" It is based on several factors such the time of day, type of structure, etc. Survivability profiling asks, "Are people *ALIVE* in there?" In situations where people are unlikely to survive the existing fire and smoke conditions, survivability profiling leads us to extinguish the fire first and attempt searches when it is relatively safe for our operating forces to do so.

An NFA instructor I once had told me, "History repeats itself. Therefore, history is predictable. If history is predictable, then it's preventable—and if it's preventable, then it cannot be an accident."[6]

We and our future leaders owe it to ourselves, our fellow firefighters, our departments and our families to help reduce preventable LODDs. It's my hope that survivability profiling will assist in that goal.

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Appendix B - May Day Emergencies

The following articles are authored by Dr. Burton Clark of the National Fire Academy.

Mayday! Mayday! Mayday!
Do firefighters know when to call it?

Dr. BURTON A. CLARK

These must be the most frightening three words that can be heard over the fire ground radio. Everyone who hears the call knows that what was a public emergency, which we the fire department came to solve, has now become an emergency for us. Something has gone wrong and one of our own needs help.

Every fire department in the country has detailed SOPs explaining who on the fire ground will do what, when a firefighter calls MAYDAY. The RIT is activated, radio channels are changed, additional chiefs and units are dispatched. We have all trained extensively on these procedures. We have developed special techniques on how to get downed firefighters out of tight spaces or up through holes. And we carry an RIT bag on the apparatus.

All this is important, but it is the easy part of the process. We have almost completely ignored the most important first step, getting the firefighter to recognize they are in trouble and need to get help, to call MAYDAY.

What mayday decision parameters have we given firefighters? How do we teach the cognitive and affective mayday decision-making process? How do we teach the psychomotor skill to execute the decision?

We have not answered these questions satisfactorily. Our standards and training are woefully lacking for this critical firefighter personal life saving competency.

The NFPA 1001 Standards for Fire Fighter Professional Qualifications (1997) does not definitively address the concept of mayday. The word mayday is not used in the standard. There is a mayday inference in the Firefighter I Standard 3-2.3 that reads, "transmit and receive via fire department radio". The firefighter is to know "Departmental radio procedures and etiquette for routine traffic, emergency traffic". The skill is " the ability to operate radio equipment and distinguish between routine and emergency traffic" (p.1001-1).

Mayday is again alluded to in Standard 3-3.4. It reads, "Exit a hazardous area as a team"; knowledge "elements that create or indicate a hazard"; skill "evaluate area for hazard" (p. 1001-7).

There is more verbiage on auto extraction then mayday in the standard. In Firefighter II the only standard that comes close to mayday is 4-2.3. It reads, communicate the need for team assistance; knowledge ;fire department radio communications procedures; skill; the ability to operate fire department communications equipment. This standard seems to be about routine assistance not mayday conditions.

The Firefighter's Handbook (2000), chapter 23, has a section titled: Firefighter's Emergencies. The opening paragraph reads in part, To help understand the actions to be taken during an actual or potential firefighter emergency, the firefighter must study procedures for rapid escape and declaring a mayday for lost or trapped situations. (p. 690). Under entrapments it reads, "The first step a firefighter should take in an entrapment is to get assistance. Activation of a PASS device is warranted and the declaration of a 'mayday' should be made over the radio. (p. 692). Under the heading of "Lost firefighter" it reads, "We cannot overemphasize that a fighter or team lost in an IDLH atmosphere is in fact experiencing a firefighter emergency" (p. 692). "First, the firefighter or team must report the fact they are lost. This is also a mayday situation and should be transmitted as such over the radio (p. 693).

Essentials of Fire Fighting (1998) does not refer to the word mayday. In the "Rescue and Extrication" chapter there is a section titled "Trapped or Disoriented Firefighters". In regard to disoriented firefighters it states, "If they are not having any success finding their way out, they should find a place of relative safety and activate their PASS devices" (p. 181).

For trapped firefighters it states, "These firefighters should immediately activate their PASS devices. If either trapped or disoriented firefighters have radios, they should try to make radio contact as quickly as possible with other personnel on the emergency scene" (p. 182). Our mayday standards and training doctrine clearly indicates that we have not researched the concept of a firefighter-calling mayday scientifically.

To study the concept of a person recognizing they are in trouble and need help, I tried to do some benchmarking by looking to others who have addressed similar issues. The place I started with was Navy fighter pilots and the concept of ejection from their aircraft.

In terms of macho, firefighters and Navy pilots are about equal. This is the first assumption I made. Next, the decision to pull the ejection cord is similar to the firefighter making the decision to call mayday. Both the pilot and the firefighter are using their last resort to save their life. The ejection mechanism and our system to save downed firefighters are useless until the individual in trouble cognitively and effectively recognize this fact and act accordingly.

When the pilot punches out, the aircraft is lost. There is the potential for injury to people and property on the ground, and the pilot may be injured or killed. When a firefighter calls mayday, other firefighters are put at risk to save him or her. The mayday decision for the fire service must be considered extremely consequential.

The ejection doctrine for pilots begins as follows. "The first and absolutely most important factor in the ejection process is the decision to eject" (Ejection seat training operations and maintains manual.

p 3-1, Environmental Tectonics Corp. Southampton PA 1999). "You should understand that the decision to eject or bailout must be made by the pilot on the ground before flying.

You should establish firmly and clearly in your mind under which circumstances you will abandon the aircraft" (Ejection seat trainer. p2. Environmental Tectonics Corp. Southampton, PA).

A key source of Navy ejection doctrine is the NATOPS manual for each aircraft. The Naval Air Training and Operating Procedures Standardization Program (NATOPS) is a positive approach toward improving combat readiness and achieving a substantial reduction in the aircraft accident rate.

Standardization, based on professional knowledge and experience, provides the basis for development of an efficient and sound operational procedure. The standardization program is not planned to stifle individual initiative, but rather to aid the Commanding Officer in increasing his units' combat potential without reducing his command prestige or responsibility. (W.D. Houser, Vice Admiral, USN. Letter of Promulgation. May 1, 1975).

The U.S. Navy F-4J jet fighter NATOPS flight manual (1995) contains the following ejection parameters:

- If conditions for no-flap carrier landing are not optimum, eject.
- If neither engine can be restarted, eject.
- If a fire exists after catapult launch, should control be lost and not regained immediately, eject.
- If control speed/gross weight combinations exceed available arresting gear limits, eject.
- If field landing cannot be made, eject.
- If hydraulic pressure does not recover, eject.
- If carrier landing and all landing gear is up, eject.
- If carrier landing and one main plus nose gear up, eject.
- If the combination of weather, landing facilities and pilot experience is less then ideal, consideration should be given to a controlled ejection.
- It is recommended that a landing on unprepared terran not be attempted with this airplane, the crew should eject.
- If still out of control by 10,000 feet above terrene, eject.
- If the flap and or BLS failure accurse during the catapult stroke or shortly thereafter, eject immediately.

It is important to remember that each different type of aircraft has its own ejection parameters. Pilot ejection training consists of classroom and flight simulator to develop cognitive and effective skill. Then the ejection seat trainer is used to imprint the psychomotor skill. Ejection retraining occurs every 6 to 12 months.

The failure or delay to eject can be attributed to 10 reasons that must be addressed in ejection training according to Richard Leland, Director Aeromedical Training Institute Environmental Tectonics Corp.

1. Temporal Distortion (time seems to speedup or slow down).
2. Reluctance to relinquish control of ones situation.
3. Channeled attention (i.e. continuing with a previously selected course of action because other more significant information is not perceived).
4. Loss of situational awareness (i.e. controlled flight into terrain).
5. Fear of the unknown (i.e. reluctance to leave the security of the cockpit).

6. Fear of retribution (for losing the aircraft).
7. Lack of procedural knowledge.
8. Attempting to fix the problem.
9. Pride (ego).
10. Denial (i.e. This isn't happing to me).

By now some readers are thinking fighter pilots have it easy because the instruments in the cockpit do not change. The positions of the needles move and when enough gages are in the red it is time to eject.

Firefighters do not have gages to read or clearly defined input data and the critical information is dynamic throughout the emergency event. Each type of structure we enter, i.e. single family, duplex, garden apartment, triple-decker, high-rise, commercial, industrial, taxpayer, etc., may require specific mayday decision parameters. Once we determine the parameters we need to recognize them and act correctly. Will we?

Over a year ago the Chesterfield, VA Fire Department conducted a lieutenant's test. Part of the testing included a field activity. Seventeen candidates for lieutenant were taken to a large abandoned building, 80 x 120 with an open floor plan. One at a time, in full turnouts, SCBA with less the 700psi, portable radio, and Nomex hood on backwards covering their face mask, each candidate was taken into the building and told the following. "You are the OIC of the first engine operating at a fire in a Shopping Mall.

You and your crew are stretching a 1 3/4 hand line at the top of the escalator on the second floor and you encounter "cold" smoke and zero visibility. While maintaining voice contact with your crew, you have been searching for the fire. You no longer have voice contact with you crew and are now lost and disoriented. This is not a training scenario, your life depends on your actions!" (By Heather Casey. Test asks: Can you Survive? Firehouse.Com News, Sept. 28, 2000). The correct actions to take were:

- Declare an emergency on the radio
- Activate the emergency button
- Announce ?Mayday, Mayday, Mayday, Emergency Traffic?
- Activate the PASS device
- Successfully merge with the RIT

Of the 17 candidates, only four took the correct action immediately. The fastest times to complete the tasks were four to five minutes. Some of the candidates never called Mayday (Personal communications Capt. Dave Daniels, Chesterfield FD Sept. 25, 2001).

This outcome should raise concern for all of us because the candidates were put into the Mayday decision parameters and most did not make the correct decision immediately. In other words they were told the gages are in the red and still did not react correctly. Remember, on the real fire ground each firefighter must read the gages, determine the meaning, and then make the Mayday decision. Again I ask. What are the Mayday decision parameters for firefighters? How do we teach the Mayday decision-making process to firefighters? How much Mayday practice do firefighters need? I don't have the answers to these questions. The military aviation method of creating ejection doctrine may serve as a model for us to use in answering these questions. We need to get our best minds researching the questions to create firefighter Mayday doctrine. I do know this. A firefighter’s decision to declare a Mayday is made in the fire station before they get on the apparatus. So, at your next company

drill, ask this question. When would you call Mayday?

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When Would You Call Mayday! Mayday! Mayday?

Dr. BURTON A. CLARK

Hopefully you will never need to call mayday for yourself, or any other firefighter. But you need to be prepared to do so because your life may depend on this single decision.

When firefighters are asked, "When would you call Mayday?" you get some unexpected answers like: "I push the orange button on my radio." or "I don't have to worry about that because I am on the engine company and I have the hose line to find my way out. It is the truckees that go above the fire that need to call mayday." These are actual answers from career firefighters in large metro fire departments.

When you push firefighters to answer the question they will usually rely on the statements in their SOP like "When Lost-Missing-Trapped and their life is in danger firefighters will announce Mayday-Mayday-Mayday." When you ask the firefighter to give an example of Lost, Missing or Trapped they have a difficult time coming up with a specific example. Then they start including statements like "It depends on your experience" even though they have never had the experience of calling mayday.

The problem is that we have not clearly defined lost, missing, or trapped. We leave it up to each firefighter to define these terms. Somehow we think firefighters will intuitively know when to call for help. This is a very dangerous assumption. Presently we do not teach firefighters when and how to call mayday at the cognitive, affective, and psychomotor levels of learning to the Mastery level of performance.

If a firefighter must perform a decision making process and execute a set of skills very rarely or never in their career but the decision and behavior have life or death consequences they must be trained and retrained throughout their career.

We can learn from how the military trains pilots to eject. First, there are very specific ejection decision parameters for each type of aircraft. The ejection decision parameters are a series of IF- THEN logic statements for example: If conditions for no-flap carrier landing are not optimum, eject. If neither engine can be restarted, eject. If hydraulic pressure does not recover, eject. If still out of control by 10,000 feet above terrene, eject (NATOPS flight manual F-4J, US Navy 1995). There can be a dozen or more ejection parameters for a specific aircraft.

Once the trainees have these memorized they will confront these parameters at any time during flight simulator training. One pilot indicated that he had to eject 60% of the time during flight simulator training. Pilot trainees must then train physically on the ejection trainer. This is an ejection seat fixed to a vertical rail that catapults the student up, simulating the ejection process. The student must pass the process at the 100% proficiency level (70% is not a passing score on one chance -- only life and death tasks).

Once the pilot and crew get their wings they still retrain on ejection every 6 months. They are also required to have flight simulator drills 6 times per year, during the training sorties they will be forced to make the ejection decision 3 or 4 times with 100% accuracy. The ejection doctrine is reviewed before every takeoff at the preflight briefing. Finally, each member of the crew realizes that the pilot is in charge of the plane but individuals are in charge of their ejection seat. Any crewmember can make the ejection decision if conditions fall with in the ejection parameters (Capt. William "Stainless" Steele USAF personal interview May 16, 2002 {Stainless is a B1 bomber pilot he and his crew ejected December 12, 2001 over the Indian Ocean}).

In spite of all this training and practice pilots still fail or delay to eject. According to Richard Leland, Director Aeromedical Training Institute Environmental Tectonics Corp., there are 10 reasons for failure or delayed ejection that must be address in ejection training:

1. Temporal Distortion (time seems to speedup or slow down).

2. Reluctance to relinquish control of ones situation.

3. Channeled attention (continuing with a previous selected course of action because other more significant information is not perceived).

4. Loss of situational awareness (controlled flight into terrain).

5. Fear of the unknown (reluctance to leave the security of the cockpit)

6. Fear of retribution (loss of the aircraft)

7. Lack of procedural knowledge

8. Attempting to fix the problem.

9. Pride (ego)

10. Denial (this isn't happening to me.)

The military model of developing ejection doctrine may be useful to the fire service to develop Mayday doctrine for firefighters. The ejection doctrine for pilots begins as follows. "The first and absolutely most important factor in the ejection process is the decision to eject" (Ejection seat training operations and maintains manual. p.3-1, Environmental Tectonics Corp. Southampton, PA 1999). "You should understand that the decision to eject or bailout must be made by the pilot on the ground before flying. You should establish firmly and clearly in you mind under which circumstances you will abandon the aircraft" (Ejection seat trainer. p2 Environmental Tectonics Corp. Southampton, PA).

Based on this assumption we developed a draft Mayday Decision Parameters for a Single Family

Dwelling (SFD). The SFD was selected because it is a basic type of structure fire common to many fire departments, it is a high risk to firefighters, and was describable. Keep in mind that we will need a Mayday Decision Parameter for each type of structure we enter. A qualitative method was used that included brain storming (individual and small group) to create the specific parameters (the first research team to help develop these parameters were John Koike, Dennis Culbertson, Tommy Harmon, Linda Pellegrini, and Tom Wiley of the NFA Interpersonal Dynamics Class Dec. 20, 2001 instructors Paul Burkhart and Howard Cross, research advisor Burton Clark). An opinion survey, using convenience sample populations (N=339), was used to determine if firefighters agreed or disagreed that they must call a mayday under specific conditions. This research methodology has significant limitations because it relies on judgment and opinion. The results are not conclusive and have not been field-tested. They are presented only to foster further discussion and study of fire service Mayday doctrine.

Survey Results 339 Respondents

MAYDAY DECISION PARAMETERS: SINGLE FAMILY DWELLING DETACHED, 1 or 2 STORY WITH OR WITHOUT BASEMENT* IDLH ENVIRONMENT SCBA IN USE

A firefighter must call a mayday for themselves under these conditions.	
% said YES	**Possible Mayday Conditions**
98%	Tangled, Pinned, or Stuck; low air alarm activation, Mayday
94%	Fall through roof, Mayday
92%	Tangled, Pinned, or Stuck and do not extricate self in 60 seconds, Mayday
89%	Caught in flashover, Mayday
88%	Fall through floor, Mayday
82%	Zero visibility, no contact with hose or lifeline, do not know direction to exit, Mayday
69%	Primary exit blocked by fire or collapse, not at secondary exit in 30 seconds, Mayday
69%	Low air alarm activation, not at exit (door or window) in 30 seconds, Mayday
58%	Cannot find exit (door or window) in 60 seconds, Mayday

***ASSUMPTIONS:** SFDs usually have a front door and back door. Most rooms, except for bathrooms, have at least one window that could be used as an exit. The exception to door and window assumptions will be the basement, attic, hallways, closets, storage areas, and attached garage. NOTE:

SFDs with bared windows or windows too small or too high from floor to use as an exit are excluded from this MDP.

Respondents: this was a convenience sample made up of National Fire Academy students N=181 Executive Fire Office Program graduates N=96, and Fire Department Instructors Conference students N=62 all respondents read the original Mayday article and or were given an oral briefing on its contents before answering the survey. The responders ranged from recruit firefighters to fire chiefs, career and volunteer, small rural to large metro.

A significant challenge to firefighters under IDLH conditions is carbon monoxide affecting their judgment, motor skills, and sensory perception. In addition the environmental conditions smoke, heat, gases, and structural stability can change very fast and become deadly. The rapid intervention team takes time to rescue a firefighter; the window of survivability can be small.

The same 10 factors that cause pilots to fail or delay ejection may apply to firefighters failing or delaying to call mayday. Is it better for 100 firefighters to call mayday and not need it, then one firefighter not to call mayday and need it? By reacting to decision parameters a firefighters perceived need for help is eliminated from their decision-making process. For example, if you fall through a floor you may not be injured, there may be no fire or smoke, you may be able to get up and walk right out of the building. The condition of falling through the floor is not normal something has gone wrong, your judgment is impacted on and the event may be fatal. Calling mayday immediately is the only 100% correct response and that still does not insure survivability.

The fire service has rules to protect us: wear you seat belt, stop at red lights, wear you SCBA, use BSI, have a backup spotter. We do not rely on the firefighter's perceived need to comply with the rule or experience of the consequences to comply with the rule. Firefighters are expected to follow the rules and we hold them accountable. No one gets in trouble for following the rules. What are the rules for calling Mayday?

The purpose of this article is to generate discussion and research on fire service Mayday doctrine. The questions we need to answer are: What are the Mayday decision parameters for firefighters? How do we teach the Mayday decision-making process to firefighters? How much Mayday practice do firefighters need?

When would you call MAYDAY? That is a good question to ask all the firefighters in your department. Let us know if they all get the answer 100% CORRECT.

Steven Auch, Captain Indianapolis FD & Raul Angulo, Captain Seattle FD contributed their knowledge and expertise to this article

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We Have Permission to Use the Word Mayday

Dr. BURTON A. CLARK

I can hear some readers now: "What do you mean we have permission to use the word Mayday- we have been using it all along! What's the big deal?" It is not a "big deal" but it is an important "little deal". Having a common understanding and use of words is a significant foundation of professionalism. In addition, words can have a powerful influence on our cognitive and affective responses to the verbal cues. Think of what happens to you when you hear the phrase "Working Fire" over the radio as you are responding. Is the term Mayday a word to be used by the fire service?

A colleague and friend Howard Cross, who studied French for six years, explained the origin of the word Mayday to me. Mayday comes from the French "m'aide" (literally; help me), the root verb being aider (to help). Knowing the source and meaning of a word is important to our comprehension.

As you know, our Firefighter I and II Standards do not use the word Mayday. When I was writing about the concept of Mayday Decision Parameters for firefighters, I was advised that the word Mayday had not been accepted as the standard firefighter distress call. Since I was studying our Mayday Doctrine, someone sent me a copy of the 2002 NFPA 1500 standard. In the Appendix A.8.1.11 in bold print, it states: "The term mayday should not be used for fireground communications in that it could cause confusion with the term used for aeronautical and nautical emergencies." My first reaction was confusion; our radios have a difficult time talking to each other across the street. How could they interfere with a plane or ship in distress?

I became curious. Who is the authority having jurisdiction (AHJ) over the word Mayday? The AHJ over the word Mayday is the National Search and Rescue Committee (NSRC) in Washington, DC. The Committee is composed of the Departments of Defense, Interior, Commerce, and Transportation, in addition to the Federal Communication Commission and the National Aeronautics and Space Administration. The Chairman is Rear Admiral Ken Venuto of the US Coast Guard.

I wrote to the Admiral at the NSRC: "Many fire departments nation wide use the term "Mayday-Mayday-Mayday" over fire ground radios as part of their emergency procedures when a firefighter's life is in danger. ?(I enclose a copy of the NFPA 1500 standard A.8.1.11) My questions are: Will a firefighter calling Mayday, on the fire ground over a fire department radio, cause confusion in the aeronautical and or nautical emergency communications system? If not, does the National Search & Rescue Committee see any reason the fire service should not use Mayday-Mayday-Mayday as the distress call for firefighters?"

> Captian Steve Sawyer US Coast Guard, Alternate Chairman, NSRC wrote me back, hear are some excerpts: "Use of MAYDAY under such circumstances is permissible under U.S. law and regulations [the ones sighted were International Radio Regulations (2001), Paragraph 4-9 and FCC rule (Part 80.311)]. The radio frequencies concerned are different from the aeronautical and maritime frequencies, so use of the term should not cause confusion. Further, any effective means of calling for help is authorized under other national and international radio regulation for true distress situations. The U.S. has taken no action to preclude use of the word Mayday by

endangered firefighters.

Mayday is recognized nationally and internationally as a signal meaning life is in danger and immediate assistance is required, although federal regulations only mention its use for ship and aircraft.

The above guidance is based on review of the regulations and consultation with experts of the Coast Guard, FCC, International Civil Aviation Organization and others.

We trust that this explanation will help not only for your local training and operations; you may also find it useful seeking to update relevant guidance in NFPA or other standards, as appropriate."

I have forwarded this information to the NFPA 1001 and 1500 committees. Thanks to our consensus standards making process, the fire service has increased its common understanding and use of words. Fire Service Doctrine comprehension helps us in our continuing quest to become a true profession. We have permission from the NSRC to use the word Mayday. Our next step is to decide if we choose to use it. Mayday the word is just a "little deal" - unless you have to call it. I pray someone hears you when you call out "help me" in any language.

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You Must Call Mayday for RIT to Work Will You

Dr. BURTON A. CLARK

BY Dr. BURTON A. CLARK, EFO; RAUL A. ANGULO; and STEVEN AUCH

You have probably participated in some type of rapid intervention team (RIT) or "Saving Our Own" training, and your SOPs may have some directions on a Mayday. The odds are, however, that you have not been given specific rules on when to call a Mayday. You are taught to be the rescuer, not the victim, and your Recognition-Primed Decision-Making process (defined below) may interfere with your calling a Mayday when you should.

What does this mean for firefighters? First, it means that we've put the cart before the horse. It doesn't matter how well trained or well equipped your RIT is. Unless the incident is witnessed, RIT teams won't be activated unless you or your partner calls a Mayday. The training emphasis has been on saving our own, not on our own calling for help. We would hate to speculate, but firefighters might have survived had they recognized early enough that they needed help or that something was out of the norm and they had called a Mayday. Deputy Assistant Chief Curt Varone, of Providence, Rhode Island, has verified our thoughts by identifying 11 structure fires between 1978 and 2002 in which failing to call or delaying a call of a Mayday contributed to 24 line-of-duty deaths (LODDs).[1]

Firefighters do not like to admit that they might need to be rescued. The delay in calling a Mayday may be caused by many factors, but three need to be addressed immediately: (1) the stigma associated with admitting to yourself and letting others know you need help, (2) not having been given clear rules for calling a Mayday, and (3) the manner in which the fire service makes decisions.

Last year, the Seattle (WA) Fire Department had three near-miss incidents involving firefighters in interior firefighting operations. Each of these incidents easily could have led to LODDs, had help taken a few more seconds to arrive. The particulars of these incidents were detailed in "Train in 'the Rule of Air Management' " (Fire Engineering, April 2003). All three firefighters—a captain, a lieutenant, and a firefighter—are seasoned veterans and well-respected members of the department.

There were some disturbing similarities in the three incidents:

1. None of the firefighters in distress called for a Mayday.
2. None of their partners called for a Mayday.
3. No one activated the emergency button on the radio.
4. No one activated his PASS device.
5. None of the partners activated a PASS device.
6. Each firefighter became separated from his partner.
7. Each firefighter ran out of air.
8. Each firefighter suffered debilitating effects of carbon monoxide.

When interviewed, one firefighter said, "I knew I was in trouble. I thought about using the radio, but I thought, 'I found my way in; I can find my way out.' "

Peer pressure and the "stigma" surrounding the idea that help is needed played a part in each incident. These firefighters realized that events were not unfolding correctly. They were all trying to find their way out of the building, but they couldn't. They all ran out of air. They all tried alternative filter-breathing techniques. But in the end, exposure to carbon monoxide impaired their judgment and motor skills.

ESTABLISH MAYDAY DECISION-MAKING PARAMETERS

To ensure that firefighters will call for help as soon as they recognize that they may be in trouble, fire departments need to develop clear Mayday decision-making parameters (rules that specify when a

Mayday must be called) and institute Mayday training programs firefighters must take and continue to pass throughout their fire service experience. The parameters/recommendations are based on logic similar to that used to establish training programs that teach military fighter pilots when they should eject from their planes in an emergency.[2]

Fighter pilots are given clear, specific ejection parameters (rules governing when to eject), and they are trained and retrained on making the ejection decision and drilled on actually pulling the ejection cord several times a year. The comparison of firefighters' calling a Mayday to pilots' ejecting from their planes makes good sense, according to Kelly M. Woods, a former Navy fighter pilot who had to eject over North Vietnam when his jet plane was shot out from under him. After military service, he became a career firefighter. He and his partner were advancing a line down a basement stairway when the stairway collapsed, pinning him under the stairs. His partner called a Mayday. Today, Woods is an instructor with the West Virginia State Fire Academy.

It may seem strange that we have to create rules to tell firefighters to call a Mayday. But, remember that we teach firefighters to be aggressive and expect them to act aggressively.

Chief Alan
Brunacini of the Phoenix (AZ) Fire Department noted at the 2002 Maryland Fire Chiefs Conference: "The hardest thing to do is to put a firefighter in reverse." Think of how we train firefighters. Do they ever fail to put out the fires in rookie school, or do they ever have to make the decision to retreat? Are firefighters ever put into training or drill situations in which they have to make the decision to call a Mayday for themselves? If the answer to these questions is no, how can we expect our firefighters to make these decisions under real-world life and death conditions?

THE DECISION-MAKING METHOD

The manner in which we make decisions may be part of the problem also. Klein Associates researchers analyzed how U.S. Army battlefield commanders make decisions. We are using the military-fire service comparison because firefighters, like the military, must make decisions "while confronting time pressure, [under] changing conditions, [for] high stakes, and [with] unclear immediate goals and incomplete information."[3]

The Klein study describes the cognitive process used to make decisions on the fireground, referred to as "Recognition-Primed Decision-Making (RPD)." As an example, officers arriving on the scene look at the picture (visual cues: fire, smoke, construction, time of day, occupancy, and so on) in front of them and then compare that picture with the pictures in their memory bank. When a match is found, they choose what worked at a similar situation in the past and use that experience to drive their strategy and tactics for the present situation.

This is a very rapid decision-making process. The first option chosen and followed is also most likely the only option considered. RPD is effective most of the time but not all of the time. Kline states: "Unfortunately, the first option may not be the best decision." (3, 43) This memory bank of pictures and actions we have to choose from has been developed over years of experience and training. It has been referred to as a "photographic slide tray." Using this analogy, we might say that "we may be missing

some slides." RPD isn't limited to command-level officers; we all use it.[4]

RPD AND MAYDAY

What does RPD have to do with Mayday? Remember that all three Seattle firefighters, two officers and one firefighter, were experienced. They had gotten themselves out of tight spots before; all said they had experienced running out of air and using the filter breathing method (disconnecting the low-pressure hose from the regulator and putting the end in the turnout coat to breathe) to get out at previous fires. None had ever had a Mayday called for them. They were using RPD to respond to the situation at hand, but it did not work this time. It is safe to assume that the Mayday-calling slide was not in their RPD slide tray.

Do you train firefighters in the simple act of using the radio to practice calling a Mayday? If not, maybe you should. For example, at a working fire, an officer fell through the floor into the basement. His radio transmission was, "14's in the basement."[5] He never called a Mayday. Other factors also contributed to this LODD. We do not know if he had the Mayday-calling slide in his RPD slide tray.

Our firefighters may not be prepared to call a Mayday for themselves. Following is a summary of research conducted for previous articles. The tests covered making decisions pertaining to calling a Mayday.

1. The New Iberia (LA) Fire Department conducted a drill to determine if the firefighters would call a Mayday for themselves. An open space 60- 2 100-foot building was used; 400 feet of hose was stretched through the building, and 18 teams of two members and one team of three members were sent in one team at a time. They were told to follow the hose and assist another team at the end of the hoseline. The conditions were immediately dangerous to life and death (IDLH), cold smoke, and zero visibility (masks were blacked out). Their SCBAs had only 800 psi in them (only three firefighters noted the low air). Thirty-nine members participated—17 captains, 14 drivers, and eight firefighters. All personnel had a portable radio assigned to them on the apparatus; only 18 of the 39 firefighters took their radio in with them. The situation made it impossible to fulfill the assignment of joining the other team at the end of the hose.

   Training Officer Martin Delaune reported the following:

   —Four kept going until their air was depleted.

   —After the low-air alarm activated, 22 kept going forward for four minutes.

   —After the low-air alarm activated, eight kept going forward for three minutes.

   —Two discussed the situation for 2.5 minutes before beginning the retreat after alarm activation.

   —Three began the retreat when the low-air alarm activated.

   —Three activated their PASS alarm.

—Two radioed a Mayday.

—None survived. They all ran out of air before they got out.[6]

2. The Fort Worth (TX) Fire Department tested about 500 firefighters (four companies at a time) in a RIT/Mayday drill. A large open-floor plan building was used. A charged 145-foot 13/4-inch attack line went from the entrance door into the building. One loop had been placed in the line. The conditions were IDLH and zero visibility (masks blacked out). The line ended at a doorway that led into a suite of three offices. A manikin was placed in one of the rooms. The teams were told to rescue the downed firefighter near the nozzle.

   About one quarter (about 130) of the firefighters were unsuccessful in exiting the building before they ran out of air. Most did not call a Mayday; all were declared nonsurvivors. The few that called a Mayday for themselves made the call outside the window of survivability.

3. The Indianapolis (IN) Fire Department used a 21/2-story wood-frame residence charged with live smoke for departmentwide RIT training. Four-member RIT teams were activated to locate a trapped firefighter who had declared a Mayday.

   Department Training Chief Doug Abernathy estimates there were 15 to 20 failures of the low-air warning system on the SCBAs worn by the rescuers. Many of the failures resulted in out-of-air situations. Other firefighters became separated from their partners. None of the rescuers called a Mayday for themselves. "We found that we have a long way to go with our RIT and Mayday training," Abernathy reported.

4. Washington Township, a department adjacent to Indianapolis, recently tested 120 firefighters in a Mayday situation. Using a large, recently abandoned restaurant and blacked-out facepieces on the SCBAs, the firefighters were taken in one at a time. All, with the low-air warning already sounding, were told that they were members of the attack crew. It was further explained that they had become separated from the others. Individually, the firefighters were spun around, to disorient them, and positioned five feet from the charged handline. Training Officer Dale Strain explained that he hoped the firefighters would then declare a Mayday over the radio and activate the alarm on their PASS device. Strain reports that all but a few did one or both procedures; he attributed this success to the Mayday training the firefighters had recently received.

MAYDAY RULES

Firefighters start developing their RPD slide tray in rookie school. Hesitation, retreat, and call for help are not learned. With this in mind, how do we learn when to call a Mayday? Throughout your career you will most likely never need to call a Mayday. We cannot rely on experience to teach us this competency—the first time may be the last time. If there is a very important skill that you very rarely need to use and you have to do it right the first time, you must drill, drill, drill—drill your entire career. Jetfighter pilots review ejection doctrine before each takeoff, and they drill on it every two months.

We developed nine "Mayday Decision Parameters" to guide firefighters in deciding when to call a Mayday in a single-family dwelling fire.[7] Individuals and small groups brainstormed to identify the specific parameters. The parameters were then submitted to sample populations of firefighters (339), to determine if they agreed or disagreed that they must call a Mayday under those conditions. These parameters are not conclusive and have not been field-tested. The nine conditions receiving the highest

number of "agreements" among those surveyed that these conditions warrant calling a Mayday are presented to foster further discussion and study.

The parameters are as follows: (1) if you become tangled, pinned, or stuck and the low-air alarm activates; (2) if you fall through the roof; (3) if you become tangled, pinned, or stuck and do not extricate yourself in 60 seconds; (4) if you are caught in a flashover; (5) if you fall through the floor; (6) if there is zero visibility and no contact with the hose or lifeline and you do not know in which direction the exit is; (7) if your primary exit is blocked by fire or collapse and you are not at the secondary exit in 30 seconds; (8) if your low-air alarm is activated and you are not at an exit door or window in 30 seconds; and (9) if you cannot find the exit door or window in 60 seconds.

It would seem that firefighters intuitively would call a Mayday if they fell through the floor. However, when we asked 339 firefighters from many different fire departments if they would call a Mayday if they fell through the floor at a single-family dwelling fire under IDLH conditions, only 88 percent said they would. What are the other 12 percent going to do? Whatever it is, it is not the correct first decision.

Ninety-eight percent said they would call a Mayday if they were tangled, pinned, or stuck and their low-air alarm activated. That still leaves 2 percent who would not call a Mayday.

The Mayday condition with the lowest "yes" response was "Cannot find exit (door or window) in 60 seconds." Fifty-eight percent said they would call a Mayday; 42 percent said they would not. Remember, this fire example was in a single-family dwelling—front door, back door, and window in most rooms. We did not choose this dwelling or the exit Mayday condition by accident. When you review the National Institute of Occupational Safety and Health firefighter fatality reports for one- and two-family dwellings, the firefighter victims were very close to a window or exit door but still failed to get out in time. One minute (60 seconds) can be an eternity. Managing air and time in IDLH conditions are critical factors in Mayday decision making.

RECOMMENDATIONS

We encourage you to be creative and to address these issues by yourself, with your crew, with your department, and with your trainees and to implement training programs that incorporate these conditions and procedures for overcoming them.

Practice calling a Mayday over the radio. Blindfold the firefighters. Have them wear gloves; hand them the radio; and see if they can turn it on, get the correct channel, push the emergency identifier button, push the talk button, and verbally call a Mayday. Have someone on another portable radio serve as communications and receive the information: Who is calling? What is the problem? Where do you think you are?

Repeat the same drill in full turnout gear with SCBA in use. Put some mattresses on top of the firefighters. See if they can get the radio out of their pocket.

As the company officer, tell your crew when you expect them to call Mayday for themselves. Give specific examples. Tell them when you will call a Mayday for them, giving specific examples such as

under IDLH conditions or "if your leg falls through the floor and I cannot pull you out on the first try, I will call a Mayday" or "if the ceiling falls on us and we get tangled in wire, we will call a Mayday and then start cutting our way out."

At the training academy, every time you have live-fire training, place crew members in a situation in which they must make the Mayday decision for themselves. The instructor can drop a cargo net over a member or block the exit. Build a prop that drops the firefighter through a trap door into a ball pit. This will also create a drill in two in/two out and RIT. It will also desensitize the others on the operational team to the Mayday call so they continue fighting the fire instead of abandoning their assignment to go to the aid of the downed firefighter.

If we want RIT and Saving Our Own to work, we need to put the Mayday calling slide into every firefighter's RPD slide tray. Then, we need to drill on it often. Because RPD "... is predicated on people choosing a course of action based on pattern matching, a comparison of the current problem to similar problems encountered before." (4,74) We cannot rely on fireground experience to teach us when to call a Mayday; therefore, we must simulate this lifesaving skill often.

A sobering thought related to the issue of RIT and Mayday comes from Battalion Chief Kenny Freeman of the Fort Worth (TX) Fire Department: "Personally, perhaps the most important issue brought to light through the RIT training involves the realization that my expectations and assumptions concerning the deployment of a RIT team were both inaccurate and unrealistic. While my previous as-sumptions were totally born out of a commonly held perspective, they would have been nonetheless ineffective and possibly tragic in the final analysis."[8]

Rapid intervention teams and Saving Our Own training are wonderful firefighter survival tools. But, like all safety equipment or SOPs, the most important component is the firefighters themselves. Just as you have to put on your seatbelt to have it protect you in an accident, you have to call a Mayday for the RIT to come to get you out. Will you?

Endnotes

1. Varone, C., "Firefighter safety and radio communications," Fire Engineering, March 2003, 141-164.

2. Clark, B. "Mayday, mayday, mayday: Do firefighters know when to call it?" Firehouse.com, October 2001.

3. Burkell, C. and H. Wood, "Make the right call," Fire Chief, March 1999, 42.

4. Varone, C., "Not your father's command post," Fire Chief, August 2001, 72.

5. "Report from the reconstruction committee fire at 400 Kennedy Street, NW," District of Columbia Fire Department, Washington, DC, October 24,1997.

6. Personal communication, March 9, 2003.

7. Clark, B., S. Auch, and R. Angulo, "When would you call mayday-mayday-mayday?" Firehouse.com, July 2002.

8. Kenny Freeman, personal communication, March 26, 2003.

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Calling A Mayday: The Drill

Dr. BURTON A. CLARK

Thanks to the cooperation of the Anne Arundel County Fire Department (AACOFD), the Maryland Fire Rescue Institute (MFRI), and the Laurel Volunteer Fire Department (LVFD) the firefighter MAYDAY concepts presented by Clark (2001, 2003) and Clark, Auch, & Angulo (2002, 2003) were put to the test and passed with high marks. The Mayday Doctrine theory is based on an analysis of the engineering, psychology, physiology, and training aspects of a firefighter calling a Mayday. This analysis used jet fighter pilot ejection doctrine models as the foundation (benchmark) for developing firefighter Mayday Doctrine.

Over a three-day period 91 firefighters and officers experienced what it may be like to call a MAYDAY using their cognitive, affective, and psychomotor skills. The overwhelming conclusion by all who participated was that everyone needs this type of training and it needs to be repeated throughout your time in the service. Battalion Chief Dave Berry of the Anne Arundel County Fire Department conducted the training for Battalion 3 on all three shifts. (photo1) The drill consisted of classroom lecture and hands on practice. Each class size was about 15 students, two drills per day (AM and PM) six drill deliveries total.

Photo By Lt. Phil Clinard Laurel VFD

Photo 1 - Battalion Chief Dave Berry of the Anne Arundel County Fire Department conducted the training for Battalion 3 on all three shifts.

Chief Berry used the mayday articles as the foundation for the lecture portion of the Battalion Drill, "Calling a MAYDAY." In addition he asked 110 firefighters "What Makes You Call a MAYDAY?" From this extensive list he narrowed the MAYDAY Parameters down to six words: Fall, Collapse, Activated (low air or PASS device), Caught, Lost, Trapped. To drive the need for Mayday training home, the Seattle, Washington Fire Department videotape of the three firefighter near misses was presented. This tape clearly illustrates how quickly a firefighter becomes incapable of calling the MAYDAY because of carbon monoxide that reduces cognitive decision-making and small motor skills and the psychological reluctance of firefighters to call for help. An additional videotape of the near LODD of an Anne Arundel County firefighter brought the point home that this can happen to you and you only get one chance to call MAYDAY correctly.

Photo By Lt. Phil Clinard Laurel VFD

Photo 2 - The prop consists of a ramp the firefighter crawls up.

The most elaborate prop simulated falling through the floor. This prop was designed and built by Engineering Technician Donny Boyd of the MFRI. The prop consists of a ramp the firefighter crawls up. (photo 2) At the top is a teeter board, which when the firefighter crosses the center of gravity, tilts forward; (photo 3) dumping the firefighter into the third part of the prop, the ball pit. (photo 4) The ball pit is actually filled with cut up swim noodles because they were less expensive than balls and are more durable. A key concern was safety of the firefighter. No one was hurt but the firefighters knew that they had suddenly fallen into something. The transportable prop was build for under $1000.00

The second prop, simulating a ceiling collapse, was made of chain link fencing that was dropped over the firefighters as they crawled under it. (photo 5) Two instructors then stood on the fence

restricting the firefighters movement and making it impossible for them to escape.

The classroom lecture also covered the three AAFD procedures for calling a MAYDAY. First, push the emergency identifier button (EIB) on the radio. This captures the channel for 20 seconds, gives an open mike to the radio (in other words the firefighter does not need to push the talk button on the radio), and sends an emergency signal to radio communications identifying the radio. Second, announce MAYDAY, MAYDAY, MAYDAY. Third give LUNAR: L location, U unit number, N name, A assignment (What were you doing?), R resources (what do you need?). The classroom portion of the drill took about 90 minutes. Chief Berry distributed a job aid, the size of a business card, to all participants; it listed the six MAYDAY parameters on one side and the three procedures for calling a MAYDAY on the other side.

Photo By Lt. Phil Clinard Laurel VFD

Photo 3 - At the top is a teeter board, which when the firefighter crosses the center of gravity, tilts forward.

The hands on portion of the drill took place in the basement of the fire station. The MAYDAY props were set up before the drill and the area was placed off limits so no one knew what they were to experience. The four MAYDAY props simulated: falling through a floor, being pinned under a ceiling collapse, getting lost / trapped in room, and becoming stuck while exiting the structure.

Photo By Lt. Phil Clinard Laurel VFD

Photo 4 - Dumping the firefighter into the third part of the prop, the ball pit.

The third prop was a small bathroom with a sink and toilet about 5x6 feet. (photo 6) A hose line with nozzle ended in this room. Once inside, the door was closed and a wooden chock placed under the door. This made it impossible for the firefighter to exit the room.

The fourth prop simulated becoming stuck while exiting a building. (photo 7) The prop was a piece of wire rope with a slip loop that was dropped over the firefighters SCBA bottle. As they continued crawling the loop tightened up making it impossible for them to move forward. Try as they may, they could not get loose. (photo 8)

One at a time the firefighters were brought to the outside basement entrance. They were in full turnout gear with SCBA. At the entry point they were given the assignment. "This is a simulated fire with IDLH conditions. You and an imaginary partner are to follow this attack line into the kitchen. When you arrive your assignment is ventilation." The firefighters were reminded of LUNAR, put on air and their face piece blacked out. (photo 9) The door was opened. They were told to go on hands and knees and follow the hose line.

Photo By Lt. Phil Clinard Laurel VFD

Photo 5 - The second prop, simulating a ceiling collapse, was made of chain link fencing that was dropped over the firefighters as they crawled under it.

The firefighters immediately had to crawl up the ramp (spotters were on either side), when the teeterboard tilted; they fell into the ball pit. The firefighters were expected to call a MAYDAY. If that was not their first reaction, the instructor prompted them, "What just happened to you?" Answer required, "I fell into something." Prompt, "What are you to do if you fall?" Answer required, "Call a MAYDAY." Prompt, "Correct, do it."

Photo By Lt. Phil Clinard Laurel VFD

Photo 6 - The third prop was a small bathroom with a

sink and toilet about 5x6 feet.

After the firefighters correctly pushed the EIB, said MAYDAY MAYDAY MAYDAY, and gave LUNAR they were told that they were done and were helped out of the ball pit. The instructor then reset the radio. They were told to go down on hands and knees again, crawl to another line, and continue their assignment. After crawling about 15 feet, the chain link fence was dropped on them. The instructors stood on the fence making it impossible to escape. Their correct response was to call a MAYDAY. If the firefighters struggled for more than a minute, they were prompted again. After calling the MAYDAY, they were released, their radio was reset, and they were told to continue their assignment. After another 15-foot crawl, they ended up in the bathroom at the nozzle; the door was chocked closed. This put them in the lost or trapped MAYDAY parameter. If after two minutes of trying to get out they did not call a MAYDAY, they were prompted. After the correct response, they were let out of the bathroom and the radio was reset. Next, they were told to find a nozzle on the floor outside the room they just left, then exit the building by following the line. The line took them around a metal fence/guard rail to a wheelchair ramp that led to the exit. As they turned the corner, a wire rope was dropped over the firefighter's SCBA bottle without their knowledge. After crawling 6 feet, the rope tightened, and they were stuck. After a minute of trying to get loose if they had not started to call the MAYDAY, they were prompted.

Lessons learned: At the first prop, most all the firefighters had to be prompted to call the MAYDAY. Their first instinct was to get out of what they had fallen into. The instructors did not let them get out. Their next challenge was pushing the EIB. This proved to be difficult for most of them and caused frustration and anxiety. The anxiety was evident by the increase in their breathing rate. The frustration was evident when some tried to remove a glove to find the button. Instructors did not allow this. They were prompted, "You just burned your hand. Put the glove back on." Most tried reaching down into the pocket to activate the EIB that usually proved unsuccessful. Some had to take the radio out of the radio pocket, in many cases this manipulation of the top of the radio caused them to change the radio channel. (photo 10) The longest time to successfully push the EIB was 2 minutes. Because of the frustration and anxiety, the LUNAR report was not always given correctly. The frustration and anxiety were most likely due to the fact that this seemingly simple skill of pushing the EIB was not easy. Pushing the emergency identifier button was challenging because the radio sat too far down in the radio pocket, gloved hands made it very difficult to activate the EIB, and the radio was a new style to the department.

Photo By Lt. Phil Clinard Laurel VFD

Photo 7 - The fourth prop simulated becoming stuck while exiting a building.

At the second prop, the firefighters quickly realized they were not getting out of whatever had fallen on them, so few needed to be prompted to call the MAYDAY. This time restricted movement challenged them because the fence was all around them. Many had to remove the radio from the pocket. Since they had performed the EIB skill once before, they knew they could do it, so they just kept working at it. As the firefighter's EIB skill proficiency level increased, their LUNAR transmission was more accurate.

At the third prop there was no restriction on them physically. Many tried to break down the door; we did not let them do that. Most still had to remove the radio to activate the EIB. They gave LUNAR, but few reported that they were in a bathroom. Only one needed to be prompted to call the MAYDAY after about 2 minutes of just sitting in the room.

Photo By Lt. Phil Clinard Laurel VFD

Photo 8 - Try as they may, they could not get loose.

At the fourth prop, they were tired and quickly realized their forward movement was stopped. In most cases the "swim technique" did not reveal the rope, so they called a MAYDAY. Their LUNAR usually did not include the fact that they were now trying to exit the building they were still reporting "division one, kitchen, ventilation, trapped."

Only one firefighter was observed to have no difficulty pushing the EIB in the pocket; he even did it without lifting the pocket flap. During the second drill period, Firefighter J.B. Hovatter was observed having not put his radio down in the pocket. He had taught himself to put the pocket flap down inside the pocket and hook the radio clip over the chest strap of the SCBA. This technique positioned the radio halfway down in the pocket keeping the controls outside the pocket, but still securing the radio to the firefighter. He quickly activated the EIB every time. It was decided to teach this technique, "The Hovatter Method", to all remaining firefighters, whose performance level increased dramatically. (photo 11)

A discussion session was held with the class after each drill to show what the props were and to get feedback. Overwhelmingly, they said it was an important learning experience and they all agreed the drill should go department wide.

What some participants said: Division Chief Allen Williams, Health and Safety Officer for the AACOFD who observed the drills said: "Hopefully firefighters will do all they can to not need to call a MAYDAY. However, firefighting is dangerous and the risk is there. Firefighters are reluctant to call MAYDAY. The training forced them to call MAYDAY. The training was excellent. The training is a very good risk management strategy."

Photo By Lt. Phil Clinard Laurel VFD

Photo 9 - The firefighters were reminded of LUNAR, put on air and their face piece blacked out.

Photo By Lt. Phil Clinard Laurel VFD

Photo 10 - Some had to take the radio out of the radio pocket, in many cases this manipulation of the top of the radio caused them to change the radio channel.

Battalion Chief Dave Berry said: "This training shocked them into calling a MAYDAY. It took some of the bravado out of them. It doesn't matter what rank you are we can all get into a situation where we need to call MAYDAY. The drill became the great equalizer. In training it is difficult to shock a person into calling MAYDAY without hurting them; these props can do that. I know now that my battalion can call a MAYDAY if they have to."

Captain Leroux said: "We needed to be coached through calling a MAYDAY; it did not come naturally. We had machismo and self-doubt. Should I or shouldn't I call MAYDAY, I'll be embarrassed. We learned how important it is to call MAYDAY quickly while you still can think and explain where you are and answer questions. It is my crew and I that go in and will be using this skill. When you get in a MAYDAY situation you are going to be so stressed out - calling MAYDAY has to come natural and this training will help."

A firefighter: "When they dropped that fence on me I realized I was done. You are calling people to come get you out. I had to concentrate on getting to the button and calling a MAYDAY."

Some veteran firefighters said, "it was the best training we have ever received in our career."

Photo By Lt. Phil Clinard Laurel VFD

Photo 11 - "The Hovatter Method", to all remaining firefighters, whose performance level increased dramatically.

Lessons learned:

- For the MAYDAY call to be completed it must be received by someone in communications, then communications must repeat back to the firefighter the information reported. This is the only way the person calling the MAYDAY will know their message was received correctly.
- The hands free feature of the radio is useful, but if the mike is turned facing the firefighter's coat the message will become muffled.
- The firefighter must speak loudly, clearly, and distinctly to be heard and understood.
- If LUNAR is not the normal day to day communications sequence for talking on the radio it may not come naturally to firefighters under MAYDAY conditions.
- In some cases the radio EIB did not reset correctly. The next time the EIB was pushed the three beeps sounded indicating the open mike was on but there was no transmission.
- It was learned that AACOFD communications could reactivate the captured channel and open the mike for an additional 20-seconds and repeat opening it as needed.
- The AACOFD is working on purchasing user-friendly firefighting gloves. This will help in using the radio.
- Situational awareness can be compromised very quickly in a zero visibility environment.
- The fact that you decided to call a MAYDAY can tax your higher cognitive thinking, like where you are and what you are doing, which are important facts for the RIC.

Calling a MAYDAY is a complicated cognitive, affective, and psychomotor skill set that relies on a radio and the communication system, both human and hardware, that gets the call for help. A failure in any component part of this system can be disastrous. We need to study, test, train, and drill the entire MAYDAY Calling system if we expect it to work when we need it.

Recommendations

First, practice calling MAYDAY. Can you push the EIB in 5 seconds with all you gear on? What happens when you push the EIB? (Does the radio channel change, who receives the EIB signal, where is it received, what do they do with the information?) Can you get to the radio when you are covered with debris? Where does the mike need to be so you can be heard? How loudly do you need to talk?

Second, include MAYDAY calling as a subset drill in all training where firefighters are put into simulated IDLH conditions. At a minimum, in rookie school and throughout their service, firefighters need to practice calling Mayday as often, if not more then, they practice-tying knots. Our bodies and minds need to be shocked into MAYDAY parameters repeatedly so the correct response becomes natural and instantaneous.

Third, get communications involved. How many times do dispatchers practice receiving and responding to a MAYDAY call? You do not want your real MAYDAY call to be the first time the radio operator gets to test their MAYDAY skills, radio equipment EIB function, and MAYDAY procedures.

Finally, whether you are the rookie firefighter or fire chief, if you put on SCBA and enter IDLH environments, you need to drill on "Calling a MAYDAY."

Authors Note: *After the pilot deliver of the drill in Battalion 6, the department moved the class to the county fire-training academy. Chief Berry was assigned to conduct the drill for the entire department. As of the end of June 2004, all 700 career and 300 active volunteer personnel in the Anne Arundel County Fire Department had gone through this "Calling a MAYDAY Drill". Congratulations to the first fire department in the nation to do so.*

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