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## **Live Fire Training**

# **You've Got the Structure, The Paperwork Is Done, You're Ready To Burn—Or Are You?**

### ***Part I***

Training fires can be even more hazardous than actual structure fires. Over the last few years we have seen it time and again regarding the injuries and deaths to firefighters on the training ground regarding live burns. They involve individuals from the rookie to the seasoned veteran and the cause of these injuries and deaths are related to several factors and consistent repetitive mistakes. Live burns are an invaluable experience in educating a firefighter's attitude and skills when involved in fire suppression activities. When you can experience heat, smoke and flame fronts in a training environment you have given the firefighter a dose of reality for the real deal. Unfortunately these experiences using acquired structures and real fires provide many inherent risks. The tragedies that can happen at a real fire can definitely happen at your acquired structure training fire. A repetitive history of departments failing in the areas of basic safety, procedures and precautions have been increasingly documented. With NFPA 1403 we can limit the risks associated with this type of training. It is very important for training officers and instructors involved in live fire training exercises to be thoroughly versed in this minimum standard that applies to the areas of acquired structures.

There has been a steady decline of actual fires as we all know over the past twenty years. But what has also declined drastically is the ability for fire departments to be able to conduct live fire training due to several factors of red tape, EPA approval, permits, contractors, home owners and a host of paperwork that needs to be done before an actual training fire can even be conducted. Finding appropriate facilities for structural live fire training can be very difficult and almost next to impossible. The main purpose and function of live fire training whether it is conducted in an acquired structure or burn building is to provide a solid quality of training in the fire experience. Training toward realism while incorporating the right skills and competencies for firefighters in order to increase fire ground safety and understanding is a clear objective. This is an excellent way in dealing with the real world responses in structural firefighting.

The relationship of a burn building or fire tower and an actual acquired structure is entirely two different animals. One is of relative concrete construction which allows for better controlled fire behavior while the other can be totally unpredictable if not prepared and planned for in the right way. The burning of an acquired structure for the purposes of conducting live fire training is a very serious matter and should not be taken lightly or gone into without understanding the risks involved. The acquired structure delivers some extreme realities in experiencing the heat, smoke and combat of fighting fires. If you don't understand fire behavior along with building construction you have no business conducting these events. There's a safe way to train and a wrong way when it comes to live fire training. In order to train firefighters and allow them the experience of live fire we must be able to minimize the potential for injury and even death.

With the enactment of NFPA 1403 we at least have a document or plan that provides us the minimum requirements for training our members under live fire conditions. Basically NFPA 1430 sets up a plan or a process and provides a checklist of conducted behaviors involving a safe approach to this type of training as well as minimizing certain risks. A good way to look at NFPA 1403 while using its guidelines for live fire training is to help you and your involvement within acquired structures to be safe and sensible. NFPA 1403 provides guidelines for both acquired structures involving interior live burns as well as fires conducted in fire buildings involving the burning of natural combustibles and also natural gas/propane fired training structures.

Even with NFPA 1403 a growing number of departments have diminished or even completely eliminated the use of acquired structures for live fire training. There are many reasons why this is happening but include the areas of liability in firefighter injuries and deaths that have occurred over the past several years. Once you have your structure you need to be able to provide the highest levels of safety along with thorough and appropriate planning as well as making sure that a good incident command system is provided for.

Now that you have your structure and your paperwork's complete you can begin thinking about a live fire exercise and planning for it properly. Remember that you are creating a real dynamic environment that can cause extreme hazards and risks to interior firefighters and firefighting suppression efforts. What should be upper most in your mind is the ability to provide great care in safety and an extremely supervised event. Safety has to be the ultimate priority and consideration. In order to help you stick to that priority you should utilize NFPA 1403 to keep you on track. Remember there is a big difference between fire in acquired structures and training in fires in a burn building. First the acquired structure will give you a limited amount of burns. It will also give you similar fires but they can become quite different depending upon the involvement of the structure. Whereas conducting fires in a burn building specifically designed for repetitive fires allows for many evolutions to be conducted without the probability of extension into its structure.

Some of the important challenges relating to live fire training deals with the experience of officers and firefighters involved in the exercises. It is very important that training officers and the instructors involved in live fire training realize that most experiences of real fire related behavior has increasingly been diminished or the last 20 years. Many of the experienced firefighters and officers have been leaving the fire service over the past few years leaving young officers with little experience making way for the inability to recognize simple fire behavior principles such as flashover and potential building collapse. They also may not have the inability to react quickly enough to avoid additional certain potentially fatal conditions when conducting live fire exercises.

Another important feature of acquired structures for life fire training is the type of structure usually provided for the event. Most of the time it is an older home as well as being a smaller home in comparison to the type of construction that are all around us today. It is very rare that a fire department will be able to acquire larger and newer home types of structures involving increased square footage as well as different types of construction features and fuel loads.

### ***Conducting The Training***

Regardless whether the structure is fixed or acquired there are certain requirements during live fire training that should be adhered to. One very important area involves the individuals participating in this type of training. Live fire training with those involved should at least have a firm basic operational skill level in fire suppression in order to participate. They should also have a firm basis of safety skills as they relate to actions and tasks on the fireground in order to prevent creating inherent safety problems to others as well as to themselves.

Those conducting the training should also have a clear and operative understanding regarding an incident management system with an instructor in charge who will be inevitably the operational command of the training exercise. This along with the required number of additional instructors must be insured in order to operate in the dynamics of life fire training.

If you are conducting a multi-company operation meaning that different functions are going on simultaneously such as fire suppression and roof operations you should allow for one instructor for each operation. Another way to look at this is to provide an instructor for the appropriate span of control of 5 to 7 members involved. Another important feature of multi-company operations is also the use of scenarios that involve multiple hose lines. Here it is a good idea to have an instructor overseeing each line involved in the suppression effort during the training event. It is important to note that when conducting scenarios involving more than one hose line at training fires that the appropriate amount of personnel to move a dedicated size line be present when operating on that line.

One of the biggest and important realizations when conducting live fire training is that you must never use a live victim in the role of a civilian or a downed firefighter in full protective clothing. Many injuries and even a few deaths have occurred during training exercises in what instructors thought provided more realism only to experience the ultimate tragedy.

Any house or structure that has been acquired for live fire training should be thoroughly examined before the lighting of the first flare into order to insure that there are no individuals such as homeless, vagrants or animals in the structure.

### ***Preparing Participants***

When companies arrive for training involving live fire a thorough briefing should be provided. During this briefing it is important that all aspects of the training, problems and their solutions are being thoroughly discussed. That all instructions are understood in regards to the expectations and the assignments that need to be covered. This along with a pre-burn look at the interior of the building by allowing all members to walk through it must be done. Even though this type of behavior would never be offered to us as firefighters when responding to a given structure involved in fire. It is

extremely important to allow those involved in live fire training to safely see and plan their operations within the structure before it is being attacked by fire. The instructors conducting the training should never conceal the burn room or where they intend to light the fire within the structure. It is of utmost importance that the walk through the structure allows the participants to see this room in order to formulate probable fire behavior and what they may be exposed to or confronted with during fire suppression efforts. It will never be the same building once it is filled with heat and smoke, but the participants in knowing the layout will be able to allow and plan for expected fire behavior in zero visibility which provides for an increase in safety.

The preparation of the participants is extremely important especially in verifying the level of training and experience that each member has. All members participating in a live fire training exercise should be observed to be in good health and physical condition. All participants should have an understanding of the incident command system as well as having an accountability procedure in place. A thorough review of the accountability system being used as well as emergency evacuation signals being used should be clearly understood by all participants. All areas of safety should be addressed including who is the safety officer and who is in charge. Make sure that it is understood that the safety officer has the ultimate authority to stop any activity or evolution at any time.

Another important feature when conducting live fire training is those instructors and those in charge should ensure that all participants are wearing the proper protective clothing. That all SCBA's and their safety alert systems are functioning properly. All instructors as well as all participants should check and review each other in order to make sure that there are no problems with equipment or exposures of skin regarding protective clothing. All SBA's should have the proper amount of air within them.

### ***Ignition of a Fire***

When everyone is ready and a decision is made to light the fire it is important for all instructors to know that the area has been cleared of personnel and that all members are in their proper positions with the understanding of their assignments. Maintaining an instructor in charge who is responsible for the overall operation that is being conducted should be clearly acknowledged by everyone participating in the exercise. There should never be more than one person in charge as well as their never being more than one person in charge of igniting the fire. It is sometimes best to assign one of the instructors as the ignition firefighter who operates under the command of the person in charge. Any decision to ignite the fire will be authorized by the instructor in charge as well as the ignition firefighter being the only one authorized to light the fire itself. There will also never be multiple fires started within the structure. A room and contents fire meaning the fuel load of natural woods and straw will only occur in one room at a time. Multiple rooms should never be lit. No fires should be lit in the areas or paths of egress that would be needed to evacuate the building. It is important for all instructors as well as the person in charge to discuss with all participants a plan for emergency evacuations including evacuation signals or communications.

Fuels that are used during live fire training should have predictable burning characteristics consistent of class "A" combustibles. Debris found within the structure that is not of this consistency should be cleared away out of the structure. There are some fuels such as woods that are treated with chemicals such as pressurized woods, rubber products, plastics of all types and flammable combustible liquids are all never to be used in training fires.

## ***Who's In Charge***

Another important feature that should be present at all live fire training in acquired structures should be the presence and appointment of a safety officer. The safety officer is not the same person that would be in charge or have overall command of the operation. This person should have a good knowledge base in the areas of fire behavior and fire suppression activities regardless of his rank. He holds and has the ultimate authority to shut down activities involved in the fire training evolution at any time due to an unsafe condition or situation.

## ***Pre-Planning Strategies***

Safety concerns involving live fire training should not only be conducted during the training event but should have been a major portion in the preplanning strategies when setting up the structure and the training evolutions for live fire training exercises. How can we be sure that an acquired structure has been safely and appropriately prepared for live fire training exercises? Let's highlight some of the important areas when preparing an acquired structure for live fire training. It is obvious that a complete inspection of the property be conducted to insure that a basic integrity of the structure itself is present. All hazardous materials found or stored within the walls or on the premises should be removed. Any containers that may be found that are assembled in such away as to provide for the allowance of building pressure under heat conditions causing them to become projectile missiles or explosives should be removed.

Roof conditions should thoroughly be examined for their integrity as well as any chimney stacks that may have the potential to collapse should also be considered for removal. Any areas on the interior of the structure that will provide for unwanted fire extension and travel such as holes in walls and ceilings should be covered. Any large objects or increased weight bearing areas should be removed or reinforced in order to avoid collapse especially in the areas above the fire training that is to be conducted. Sometimes it's a good idea to even remove bathtubs on second and third floors depending upon where their relationship is to the areas of fire training or rooms of ignition.

## ***Operations and Activities***

During all live fire training exercises another important feature to remember when conducting multi-company tasks is to avoid allowing companies to engage in activities above the fire area except in the case of roof operations. Serious injuries and deaths have occurred in rooms and areas above a live fire training exercise. In order to avoid many of these situations good preplanning involving and providing for adequate ventilation openings should be created predominantly in the roof areas of the structure. This will allow for the escape of heat and toxic smoke as well as any other explosive type gases.

Additionally all participants should be briefed on the proper hose line advancement techniques as they relate to the nozzleman, backup man, turn or door man and officer. Members on the hose line should review and check the nozzles patterned position and flow before entering structure. Participants entering a structure under live fire conditions will be in a crawling position with the hose line and nozzle between the participants and the fire at all times. The interior live fire instructors along with the acting company officer will supply the direction to the nozzleman regarding application of water to the fire. This will avoid a complete knock down or extinguishment of the fire area in order to continue repetitive live burns in the same room or area. All members on the hose line

should be accounted for after the knock down of the fire and then retreat from the building with the hose line making sure to stay low. After all participants are outside of the structure another accountability check should be conducted and to make certain that there are no minor injuries.

When conducting live fire training in acquired structures instructors should be sure to establish at least 3 hose lines in a ready position before ignition of the fire and entry of participants into the structure. One hose line will be used by the participants advancing and attacking the fire while an additional hose line will be placed for the purposes of a backup crew and a final third to be used as a safety line kept in the burn area.

Ventilation activities will ultimately be provided and controlled by the instructors making sure that ventilation is occurring continuously in order to avoid buildup of extreme heat and gases. Ventilation activities should also occur during water application on the fire in order to lift smoke and steam away from the attack crew.

In summary conducting a safe live fire training exercise in an acquired structure it is imperative that the preparation of the training site, the students or participants along with safety briefings be provided with everyone paying strict attention in what is to be expected regarding the evolutions.

During the preplanning of the live fire training exercise it is a good idea to mark all egress areas with brightly colored paints. Make certain that all utilities have been disconnected. If you can't make the building safe and adhere to NFPA 1403 than take into consideration that it may be best not to use it.

## **PART II**

### **How to Get the Most Out Of Room and Content Burns.**

#### ***Burn Buildings***

Burn buildings or burn towers are structures that are fire resistive and constructed of concrete. They are designed specifically for repetitive use and allow for a consistent fire dynamic that are experienced by those training in them. Fires that are set in these buildings usually do not spread like they do in acquired structures. Respectively the fire simply gets larger or smaller at a specific location in a burn room within the burn building depending on the fuel load provided. Combustible class "A" materials such as pallets and straw are set up or piled up in an area within the room and then light. If a large fuel load of these materials is supplied you can create excessive heat conditions sometimes so intense that they can melt helmets and protective clothing. Creating some of these fires and conditions is not the reality of fighting fires nor do they provide certain realisms that firefighters are exposed to at the real deal. Because of the type of construction of burn buildings which are predominately concrete it is relatively easy to create these intense temperatures. Normally these types of temperatures would be telling us to get out of the structure when fighting fires out in the real world.

The problem with these structures is the tendency to provide an unrealistic view of the properties of fire growth and behavior. Typically a 20 by 20 open room has placed in it a pile of pallets and hay and then light as firefighters are then told to go in and put the fire out. The fire is usually easily found and in a common location every time. Unlike in real fires in acquired structures or actual structure fires a search for the fire through dark smoke is usually the case. In real fires the fire spread is capable of getting larger and larger and moving from one room to another. In burn buildings fires do not actively continue to grow and go across the ceilings or over your head as they would in a real room and contents fire. We should also remember that it is also spreading into the structure itself at real fires. As stated earlier another problem with concrete burn rooms is that excessive temperatures can be created. Firefighters would not normally present themselves within these types of excessive temperatures. Realizing that they would be exposing themselves to possible flashover conditions they would immediately leave.

Another aspect of concrete burned buildings and their content fires that we create is that their ceilings are not affected by the fires growth or travel. In real fires as well as in acquired structures ceiling materials burn and fall from overhead. Usually when these fires are set up in burn concrete buildings little attention is given in adding furniture and other materials found at real structure fires. In essence instructors may not provide the creativity in realism in setting up a room within the burn building.

It is interesting to note that even in concrete burn buildings or burn towers we still have to comply with NFPA 1403. At the same time there are ways to become creative and inventive in supplying additional realism within a burn building while still being compliant with the standards of NFPA 1403. We must also realize that within a concrete room we can provide certain types of materials and furnishings knowing that the fuel load will never affect the structure creating fire dynamics that would be unpredictable. The following are some ideas in how to get the most out of a burn room made of concrete usually found in burn buildings or burn towers which will enhance more realism in your scenarios.

### ***Materials***

The following list of materials is all encompassing. It is not meant that all of these items and materials necessarily be used at one time. More importantly they are to be used creatively together or separately to create more realism in fires established in these types of structures.

Another important note is that many of these materials require that they may be attached to walls and ceilings through the use of materials such as angle or straight iron bolted to the walls with hooks or some type of clasp systems coming off the iron strips that are attached to the walls. Which ever application is used it is imperative that you are not compromising the structure or allowing a situation to be created to cause fire extension from one room to another.

For an approximate 20 x 20 room:

- 1 Wood frame couch/without cushions.
- 1 Wooden chair
- 1 Wooden side table
- 1 Metal small garbage can
- 1 Set of cloth drapes on a metal rod/not to exceed 48 inches.
- 1 Metal or wood floor/table lamp/plastic shade removed/use cloth shade.
- 10-12 Pallets/to be used as needed not all at once.
- 4 Bails of hay/to be used as needed not all at once.
- 1 Small carpet/thin/without rubber backing/rattan
- 2 sheets of compressed wood chip particle board.

### ***Suggested Use of the Materials***

By reviewing the above list of materials and furnishings we can see the possibilities and creative ways we can enhance the realism that a room and contents fire would produce. Let's begin by looking at these items along with their use and setup.

First we have the couch. It is important that when acquiring a couch that it's framing and exterior presentation is predominantly made of wood. It is also important that all cushions are removed since they do not comply with NFPA 1403 due to their chemical makeup which produces an increase in heat and fuel load. We will replace the cushions with thin sections cutoff from the bales of hay acting as the cushions. This will obviously produced a realistic acceptable fire dynamic when it burns.

The wood frame chair may also have a cushion that needs to be removed and replaced by a cut section from the bail of hay. It is then placed in the room where you want it relative to the rest of the furnishings. The same can be said for the wooden side table or end table.

The small metal garbage can could be used as the ignition point of the fire by filling it with paper and hay while placing it next to the couch and its cushions made of hay. Or it can be placed in an entirely different location and used to either help start the fire or simply as a prop. This along with a few pallets placed in a configuration into the setting with some hay will guarantee ignition. Remember in order to create the proper fire growth and entrainment of air it is best to avoid setting the materials and furnishings in the middle of the room. When this arrangement is set it allows drafting larger air entrainment into the fire causing it to free burn very quickly. You'll create a lot of flame, some heat but less smoke as well as the materials and furnishings to be consumed quickly. You should rather set up your materials and furnishings at corner of the room but keeping off the walls. This will create steady fire growth and a good fire plume distributing flame, heat and smoke across ceiling areas along with good bank down as is found in structural fires.

The cloth drapery is another feature to add realism to any room and contents fire. In a burn building they should be hung with their metal rod over a possible metal shuttered window opening as usually found on these types of structures. The reason we do not exceed 48 inches of drapery material is because of the likelihood that the material itself may not be a hundred percent cotton and will have an additional makeup of synthetic materials in it.

The floor lamp should be predominantly made out of wood and metal providing for a known combustible type burn. Plastic lamp shades are usually removed due to their plastic makeup of hydrocarbons and heat producing fuel loads. They can easily be replaced or substituted with a makeshift lamp shade made of cloth or heavy cardboard. They can then be placed within their relative setting near the other furnishings.

The acquired pallets can be used with hay to start fires or create fires as you normally would within a concrete burn room. Here we are suggesting that they or portions of them are attached or hung on the walls near the setting of the furnishings. This will provide an increase in realism through their auto ignition from radiant and conducted heat sources from the fire. They can also be used over and over again because they would never totally burn through and would burn again once another fire is set for additional evolutions. Pallets or portions of them can also be attached to ceilings over the immediate fire area of ignition which provides additional realism in having fire travel overhead as they do in real structure fires. It is important to note when utilizing this technique that drop-down from fire brands and pieces of wood should be expected and that all members should be covered with the proper protective clothing and helmets with the chin straps applied. When attaching pallets to ceilings they should be secured firmly in order to guarantee that they would never drop-down as one-piece. This is an excellent way to provide additional realism to the burn.

The particle board that is mentioned can also be used on the walls and on the ceiling. It should be cut into 2 ft. strips and placed in that fashion. No more than two sheets cut into the 2 ft strips should be used at one time for any given fire scenario. Again adhering to NFPA 1403 the concerns regarding the particle board is not the compression of the wood chips but the glue bases that may be used in holding them together.

It is important to note that what ever types of woods are being used that they should never be chemically treated. We're looking for the most natural woods in order to provide clean and safe burning. When attaching wood products onto ceiling and walls it is important that they are only applied in the areas of origin of the fire that is being set. At no time will these products be wrapped around an entire room or near entry ways whether they are overhead or on walls. By doing so will cause an unacceptable fuel load as well as possibly producing fires behind companies and their initial entry ways.

### ***Acquired Structures***

Some of the best training and also the most realistic can be provided through the use of acquired structure. Acquired structures offer realism in a truer sense regarding fire dynamics to the training firefighter as it relates to fire suppression activities at real fires. Before we begin to train or light fires in these structures it is extremely important that the inside and outside of these buildings are properly prepared following NFPA standards and guidelines. When we light a fire in a real building we will experience real conditions. With these real conditions come the real potentials regarding fire dynamics that may pose safety risks to those training within and around the structure. Whereas in a burn building a light fire never really leaves a room, it is quite different in an acquired structure where there can be possible involvement of the structure itself as well as extension into other areas. Fire as we know in real structures along with their construction features provide for the fires ability to extend and travel into walls and ceilings. This type of training is an invaluable experience to firefighters giving them a truer perspective on what to expect at the real deal. At the same time if the preparation and the awareness of those training at these acquired structures is not conducted properly injury and death may result.

To emphasize the point again safety and control in this type of training is paramount as stated earlier along with paying attention to the guidelines provided by NFPA 1403. The following information provides for the setting up, preparation and materials needed for a room and contents fire established within NFPA guidelines while allowing for some creativity. Through the use of this type of preparation we will be able to get multiple burns out of one particular room while minimizing its extension into the structure. We can also control the fuel loads by using close to natural products as seen in class "A" materials and additionally be able to better control the growth and spread of fire while promoting realistic conditions.

### ***Suggested Materials and Preparations***

2 Rooms 13x15 (average)\*note any room used should be configured and prepared in a similar manner. Rooms chosen for burning will have floor joist systems below them completely in tacked or reinforced. All holes patched or covered. All routes for fire travel such as pipe chases and utility installations through walls and ceilings sealed off.

Two rooms should be set up at one time alternating burns between both. This allows for repeated evolutions by alternating between them while allowing for cooling and drying of each room after each ignition. Rooms should be far enough apart as to not allow fire extension to ignite through radiation, convection or direct flame contact to the other room or any of its furnishings and materials.

8 4x8 ½" drywall  
Screw gun and drywall screws  
4 8x4 ¾" plywood  
4 10ft. 2x4's  
Collected furnishings as used above in Burn Buildings.  
Pallets and Hay  
Electric powered saw for cutting plywood and other materials.  
Hammer and 16p nails

### ***Fire Behavior and Suppression***

The use and set up of the drywall is very important in regards to its placement. The drywall provides several purposes. First it covers surfaces. It also can contain heat and it can direct heat and flame within the structure away from the structural members of the building itself. This is possible only for a certain amount of time before inevitably the structural components and void spaces of the structure would become affected. Remember we are only allowing the fire to grow and burn to a certain extent and only for a certain amount of time. Another words we are not allowing the fire to rip through the house but to control it just enough to allow it to leave the upper doorway or entrance to a room. We judge this by flame fingering that is going across a ceiling within the fire gases along with the smoke velocity approaching and arriving at the entryway to the room as well as filling the rest of the house. When the flame fingers are just emanating out of the upper portions of the doorway to the room extinguishment must take place immediately. In order for multiple burns to take place within the same room the training instructors should monitor the use of the application of water as well as nozzle operations. The suppression company and the nozzleman should direct short bursts of water to the flame fingering and gases at the ceiling level, then sweep the floor into the room and then aim for the origin of the fire. At this point the instructors will allow the room to lift insuring that the main body of fire is out. The instructors will then indicate to the nozzleman if continued extinguishment is required in short burst. The instructor will then direct the suppression company to exit the structure with the hose line while he remains inside ventilating and checking for extension. If fire is found into the structure it will be contained and controlled by any necessary overhaul utilizing the secondary line already placed in the structure near the fire area before the exercise began. At this time any areas that need recovering can be addressed by those assisting with the live burn. After each evolution training companies should be allowed back into the structure after its ventilation to critique the training experience.

It is at this point that the same type of exercise will be conducted on the secondary room that has already been previously prepared. By alternating rooms and their burns we allow for the burning of one room to help dry out the previous burn conducted to the other room. This along with the proper control by instructors in allowing specific water applications by the training companies will maximize the ability to acquire repeated burns of the rooms in the structure. By providing proper preparation of the rooms we will ensure not loosing them to full involvement causing severe fire damage to the structure limiting the amount of burns it can provide.

Let's go back to the materials list and how we incorporate it in preparing a room for a live burn. First we will not discuss the gathering and placement of furnishings other than you can be as creative as you want when setting up a furnished room. What is important is that you follow the same guidelines as required in the information provided earlier for burn buildings or fire training towers in order to adhere to NFPA1403.

The drywall as we stated earlier has its purposes in controlling, protecting and directing flame and heat. There is a specific layout of the drywall that should be applied similarly to every room we choose to burn in.

The pallets and hay used for acquired structures should be used to initiate the fires growth. Unlike burn buildings we cannot simply pile several pallets miles high and stuff it with bails of hay. If we did the structure and its infrastructure would be affected and we could loose the building to fire as well as jeopardizing the safety of those involved. We should also never attach pallets and hay to walls or ceilings in an acquired structure for live burns. In spreading these kinds of fuel loads along combustible walls and ceilings we are creating increased surface areas which can cause rate of rise temperatures to create premature flashover conditions.

### ***Controlling The Burn/Preventing Fire Extension***

First as stated earlier we must cover all avenues of fire extension regarding unwanted holes and cut-aways through the walls and ceilings of a room. Next we need to establish the specific area in the room where the main body of ignitable combustibles will be. Remember that combustibles piled or placed in the center of a room will burn more freely and faster possibly providing a loss of control by the instructors in regards to the fires speed of growth. Whereas placing furnishings and combustibles closer to walls such as in the corner of a room will allow the entrainment of air into the fire more slowly and evenly. When we say in the corner of a room we do not mean right up against the walls but allowing for adequate space around the materials so as to be more away from the walls. This allows for better entrainment of air currents and a more evenly controlled plume of heat and fire gases up into the room to allow it to move across a ceiling towards an entryway. This is what is known as intentional fire directing and controlled fire behavior allowing for a more timed and directionally controlled event when incorporating fire suppression training. In order to do this we need to apply protection to surfaces within the room so as to prevent or delay the heat, gases and flames from attacking the infrastructure of the structure. Another words the framing and interior spaces of walls and attics must be protected to delay their involvement. That is unless we would like fire to travel to these areas in which case this would then not be conducive to a safe and proper burn for live fire training.

Back to the placement of the drywall! Pick the corner of the room where the burn will take place. Cover this area at the ceiling squaring in the drywall into the corners above at the ceiling and on the upper walls at the corners. The best way to attain the positioning of the drywall is to be sure to cut drywall board into even 4x4 sections placing them like large tiles. Behind the combustibles in the corner at the base of each joining wall should be placed a 4x4 piece of drywall. Add another directly on top of those. Add an additional 4x4 to each side of those and then another to each side of those on the walls on each side. This will bring you a covering distance of approximately 12 feet of the upper wall of a room. If the room is smaller cut the last piece to fit. Depending on the height of the room will depend how high you need to continue to go up. 2 4x4 sections put one directly over the other will usually equal the height of a room with some over lap at the center seam.

The ceiling should be covered in a square made up of 4x4 pieces off the corner of the room with a single row of drywall pieces running along the sides of the ceiling where it meets the wall touching the other drywall pieces on the upper walls. Place a pair of 4x4 pieces touching the square pieces formed on the ceiling towards the direction of the doorway or entryway to the room. You are not covering the whole ceiling just the area of assumed fire travel. Do this until you reach the doorway fitting the pieces at the ceiling right up to the doorway header. Now apply one 4x4 piece of drywall to each side of the door jamb trim at the top part of the wall where it meets the ceiling. Fill in a piece above the door on the wall to the ceiling. You will also apply this to the outside area of the door jamb area on the wall at the ceiling. You will then place 2 4x4 pieces of drywall on the ceiling at the wall right over the doorway. You will then cut pieces of drywall to fit and cover the entire header of the doorway inside and outside the doorway.

By preparing a room in this fashion you will be able to provide repeated burns and less chance of allowing fire into the structure. You will also provide more realism within the structure regarding fire travel, smoke conditions, smoke travel, heat currents, dropdown conditions from the drywall application during water application as well as ember dropdown and drywall dropdown. All this can be obtainable when done properly which will reduce the damage and possibilities of fire extension into the structure. Remember that proper size ventilation holes must be pre-cut above fire areas on the roof which will also allow for less damage and more productive burns.

It is recommended that during the first burn evolution you do not cover the windows if the glass and sash are present with the plywood. Allow the window to blow out in order to allow companies to deal with real fire conditions. Be sure to guarantee that no fire extension or lapping will occur during the exercise to the floor or space above. After the first evolution the window/s will need to be cover over in plywood. The plywood material should be applied and fastened in such a way that the material can be easily removed or pushed in or out from either side that it is fastened from.

### ***Ventilation***

None of this will work unless one of the major areas of concerns of fire behavior is addressed at live burns and that's proper ventilation. When we talk about ventilation we refer to adequate controlled ventilation for live burns in acquired structures. This is accomplished through providing the making of proper sized and properly placed ventilation holes on the roof of the structure. Ventilation holes should be placed not only at the high points on a roofs pitch but ordinarily over the fire area as well. When burning in acquired structures it is imperative that multiple ventilation holes are made. A good rule of thumb is to provide 2 ventilation openings of a minimum size of a 4x4 opening made on each side of a pitched roof at opposite ends. One of the openings should be closer to where the rooms of the burn areas are. Also if another pitched roof intersects another portion of a roof another ventilation hole should additionally be provided for on that portion. These tactics provide for greater control and safety from the build up and pressures from heat, smoke and hot gases giving us more control of the interior fire dynamic making it much safer.

The construction of these ventilation holes on the roof should be prepared in such a way as to be totally manipulated at will and with great ease. Cut holes 3 1 /2 x 3 1/2 at the proper locations relative to the burns and then frame them in on 3 sides leaving the top open. Make sure when utilizing the 2x4's for framing that the frame allows for a piece of 4x4 cut plywood to slide easily within it. Nail a make shift handle to one side of the 4x4 piece of plywood along one of its sides so you can grasp it and slide the plywood out of the framing from the other side of the ridge. Do the same for the other ventilation hole at the other location and so on. By making these ventilation holes easily manageable we can provide safety for those inside as well as those on the roof. Remember these fires should never be allowed to get to a point that they would jeopardize those training inside as well as those attending on the roof.

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