Acquired Structures

CHAPTER

6

NFPA 403 Standard

4.2.1* Any acquired structure that is considered for a structural fire training exercise shall be prepared for the live fire training evolution. [p 106–114]

4.2.2* Preparation shall include application for and receipt of required permits and permissions. [p 103]

4.2.3* Ownership of the acquired structure shall be determined prior to its acceptance by the AHJ. [p 103]

4.2.4 Evidence of clear title shall be required for all structures acquired for live fire training evolutions. [p 103]

4.2.5* Written permission shall be secured from the owner of the structure in order for the fire department to conduct live fire training evolutions within the acquired structure. [p 103]

4.2.6 A clear description of the anticipated condition of the acquired structure at the completion of the evolution(s) and the method of returning the property to the owner shall be put in writing and shall be acknowledged by the owner of the structure. [p 103]

4.2.7* Proof of insurance cancellation or a signed statement of nonexistence of insurance shall be provided by the owner of the structure prior to acceptance for use of the acquired structure by the AHJ. [p 103]

4.2.8 The permits specified in this chapter shall be provided to outside, contract, or other separate training agencies by the AHJ upon the request of those agencies. [p 103]

4.2.9* All hazardous storage conditions shall be removed from the structure or neutralized in such a manner as to not present a safety problem during use of the structure for live fire training evolutions. [p 109]

4.2.9.1 Closed containers and highly combustible materials shall be removed from the structure. [p 108, 112]

4.2.9.2 Oil tanks and similar closed vessels that cannot be removed shall be vented to prevent an explosion or over-pressure rupture. [p 108, 112]

4.2.9.3 Any hazardous or combustible atmosphere within the tank or vessel shall be rendered inert. [p 112]

4.2.10 All hazardous structural conditions shall be removed or repaired so as to not present a safety problem during use of the structure for live fire training evolutions. [p 112]

4.2.10.1 Floor openings shall be covered. [p 111]

4.2.10.2 Missing stair treads and rails shall be repaired or replaced. [p 108, 113]

4.2.10.3 Dangerous portions of any chimney shall be removed. [p 109]

4.2.10.4 Holes in walls and ceilings shall be patched. [p 111]

4.2.10.5* Low-density combustible fiberboard and other unconventional combustible interior finishes shall be removed. [p 111]

4.2.10.6* Extraordinary weight above the training area shall be removed. [p 112]

4.2.11 All hazardous environmental conditions shall be removed before live fire training evolutions are conducted in the structure. [p 109]

4.2.11.1 Debris creating or contributing to unsafe conditions shall be removed. [p 109]

4.2.11.2* Roof ventilation openings that are normally closed but can be opened in the event of an emergency shall be permitted to be utilized. [p 109]

4.2.11.3 Utilities shall be disconnected. [p 108]

4.2.11.4 Any toxic weeds, insect hives, or vermin that could present a potential hazard shall be removed. [p 106]

4.2.11.5 All forms of asbestos deemed hazardous to personnel shall be removed by an approved asbestos removal contractor. [p 108]

4.2.12.1 Exits from the acquired structure shall be identified and evaluated prior to each training burn. [p 106–108]

4.2.12.2 Participants of the live fire training shall be made aware of exits from the acquired structure prior to each training burn. [p 113]

4.2.13 Buildings that cannot be made safe as required by this chapter shall not be utilized for interior live fire training evolutions. [p 102]

4.2.14 Adjacent buildings or property that might become involved shall be protected or removed. [p 102]

4.2.15 Utility services adjacent to the live burn site shall be removed or protected. [p 108]

4.2.16 Trees, brush, and surrounding vegetation that create a hazard to participants shall be removed. [p 106]

4.2.17 Combustible materials, other than those intended for the live fire training evolution, shall be removed or stored in a protected area to preclude accidental ignition. [p 109]

4.2.18 Property adjacent to the training site that could be affected by the smoke from the live fire training evolution, such as railroads, airports or heliports, and nursing homes, hospitals, or other similar facilities, shall be identified. [p 102]

4.2.19 The persons in charge of the adjacent properties identified in 4.2.18 shall be informed of the date and time of the evolution. [p 114]

4.2.20* Streets or highways in the vicinity of the training site shall be surveyed for potential effects from live fire training evolutions, and safeguards shall be taken to eliminate possible hazards to motorists. [p 102]

4.2.21 Fire lines shall be established to keep pedestrian traffic in the vicinity of the training site clear of the operations area of the live burn. [p 114]

4.2.23 The instructor-in-charge shall determine the rate and duration of waterflow necessary for each individual live fire training evolution, including the water necessary for control and extinguishment of the training fire, the supply necessary for backup lines to protect personnel, and any water needed to protect exposed property. [p 104–105]

4.2.23.1 The minimum water supply and delivery for live fire training evolutions shall meet the criteria identified in NFPA 1142, *Standard on Water Supplies for Suburban and Rural Firefighting* .[p 104–105]

4.2.23.2 A minimum reserve of additional water in the amount of 50 percent of the fire flow demand determined in 4.2.23.1 shall be available to handle exposure protection or unforeseen situations. [p 104–105]

4.2.23.3* Separate sources shall be utilized for the supply of attack lines and backup lines in order to preclude the loss of both water supply sources at the same time. [p 104–105]

4.2.24.1 An area for parking fire apparatus and vehicles that are not a part of the evolution shall be designated so as not to interfere with fireground operations. [p 106]

4.2.24.2 If any of the apparatus described in 4.2.24.1 is in service to respond to an emergency, it shall be located in an area to facilitate a prompt response. [p 106]

4.2.24.3 Where required or necessary, parking areas for police vehicles or for the press shall be designated. [p 106]

4.2.24.5 Ingress and egress routes shall be designated, identified, and monitored during the training evolutions to ensure their availability in the event of an emergency. [p 106–107]

4.2.25.3 All features of the training areas and structure shall be indicated on the preburn plan. [p 103]

4.2.25.4 Prior to the conduct of any live fire training, all participants shall be required to conduct a walk-through of the acquired structure in order to have a knowledge of and familiarity with the layout of the acquired structure and to facilitate any necessary evacuation of the acquired structure. [p 103, 116]

4.2.26 All spectators shall be restricted to an area outside the operations area perimeter established by the safety officer. [p 114]

4.2.26.1 Control measures such as ropes, signs, and fire line markings shall be posted to indicate the perimeter of the operations area. [p 114]

4.2.26.2 Visitors who are allowed within the operations area perimeter shall be escorted at all times. [p 115]

4.2.26.3 Visitors who are allowed within the operations area perimeter shall be equipped with and shall wear complete protective clothing in accordance with manufacturer's instructions and in accordance with 6.4.17.1 through 6.4.17.7. [p 115]

4.2.27 All possible sources of ignition, other than those that are under the direct supervision of the person responsible for the start of the training fire, shall be removed from the operations area. [p 113, 117]

4.3.1 The fuels that are utilized in live fire training evolutions shall have known burning characteristics that are as controllable as possible. [p 115]

4.3.2 Unidentified materials, such as debris found in or around the structure that could burn in unanticipated ways, react violently, or create environmental or health hazards, shall not be used. [p 111, 115]

4.3.3* Pressure-treated wood, rubber, and plastic, and straw or hay treated with pesticides or harmful chemicals shall not be used. [p 111, 115]

4.3.4* Fuel materials shall be used only in the amounts necessary to create the desired fire size. [p 113]

4.3.5 The fuel load shall be limited to avoid conditions that could cause an uncontrolled flashover or backdraft. [p 113]

4.3.7* The instructor-in-charge shall assess the selected fire room environment for factors that can affect the growth, development, and spread of fire. [p 113]

4.3.8* The instructor-in-charge shall document fuel loading, including all of the following:

(1) Furnishings

(2)Wall and floor coverings and ceiling materials

(3) Type of construction of the structure, including type of roof and combustible void spaces

(4) Dimensions of the room [p 113]

4.3.9* The training exercise shall be stopped immediately when the instructor-in-charge determines through ongoing assessment that the combustible nature of the environment represents a potential hazard. [p 103]

4.3.10 An exercise stopped as a result of an assessed hazard according to 4.3.9 shall continue only when actions have been taken to reduce the hazard. [p 103–104]

4.4.6* The instructor-in-charge of the live fire training evolutions shall determine, prior to each specific evolution, the number of training attack lines and backup lines that are necessary. [p 104–105]

4.4.6.1 Each hose line shall be capable of delivering a minimum of 360 L/min (95 gpm). [p 104]

4.4.6.2 Backup lines shall be provided to ensure protection for personnel on training attack lines. [p 104–105]

4.4.13 A search of the acquired structure shall be conducted to ensure that no unauthorized persons, animals, or objects are in the acquired structure immediately prior to ignition. [p 116]

4.4.15 Only one fire at a time shall be permitted within an acquired structure. [p 113]

4.4.16 Fires shall not be located in any designated exit paths. [p 113]

4.4.19 One person who is not a student shall be designated as the "ignition officer" to control the materials being burned. [p 116]

4.4.19.1 The ignition officer shall wear full protective clothing, including SCBA, as required in 6.4.17.1 through 6.4.17.7, when performing this control function. [p 117]

4.4.19.2 A charged hose line shall accompany the ignition officer when he or she is igniting any fire. [p 117]

4.4.19.3 The decision to ignite the training fire shall be made by the instructor-in-charge in coordination with the safety officer. [p 117]

4.4.19.4 The fire shall be ignited by the ignition officer in the presence of and under the direct supervision of the safety officer. [p 116]

9.1.2* For acquired structures, records pertaining to the structure shall be completed. [p 103]

9.1.3 Upon completion of the training session, an acquired structure shall be formally turned over to the control of the property owner; the process shall include the completion of a standard form indicating the transfer of authority for the acquired structure. [p 121]

Additional NFPA Standards

NFPA 1142 *Standard on Water Supplies for Suburban and Rural Firefighting*

Knowledge Objectives

After studying this chapter, you will be able to:

- Define an acquired structure according to NFPA 1403.
- Describe how to perform an initial evaluation on an acquired structure.
- Identify the responsibilities of the owner of the acquired structure.
- Identify the information that must be included in the preburn plan for an acquired structure.
- Describe how to ensure the water supply is adequate for training evolutions.
- Describe how to prepare an acquired structure for live fire training.
- Describe how to secure access to the site of the acquired structure.
- Identify the equipment and supplies required to prepare an acquired structure for live fire training.
- Identify the precautions to take to ensure proper entry and egress for the acquired structure.
- Identify the structural elements to evaluate when preparing an acquired structure for live fire training.
- Describe the steps of preparing the interior of an acquired structure for live fire training.
- Describe how to ensure the safety of the occupants of the homes and businesses adjacent to the acquired structure.
- List the equipment and supplies required for live fire training in an acquired structure.
- Describe how fuel for ignition is prepared safely.
- List the steps to follow prior to the ignition phase.
- Describe how to ensure safety in preparing for and during the final controlled burn.
- Describe tasks involved in the overhaul phase.
- Describe the benefits of a postevolution debriefing.

Skill Objectives

After studying this chapter, you will be able to:

- Inspect and prepare an acquired structure for live fire training.

You Are the Live Fire Training Instructor

As the training officer for your fire department, the chief has advised you of a citizen's offer to donate a structure to use for live fire training. You will be the instructor-in-charge of the live fire training evolution, and as such you will be responsible for personnel safety, protection of adjacent properties, and meeting the objectives of the training. How can you ensure the following:

1. Is the structure prepared for the evolution?
2. Are the fuel materials identified and do they have known burning characteristics?
3. What are the functional positions that need to be filled and how do you fill these with competent and knowledgeable personnel?

Introduction

NFPA 1403, *Standard on Live Fire Training Evolutions*, defines an **acquired structure** as one that is obtained by the authority having jurisdiction from a property owner for the purpose of conducting live fire training evolutions. There are a number of considerations to take into account when evaluating possible structures for live fire training exercises. This chapter will assist you, as the live fire training instructor, in readying a structure and conducting a safe and successful training within an acquired structure.

Initial Evaluation

One of the first questions asked when evaluating a structure for live fire training exercises will be, "Why does the individual want to let the fire department burn down their building?" One reason may be that the building has structural issues. If this is the case, the building may have lost value to the owner, which also would mean that it has no value to the fire department. The condition of such structures can pose significant dangers to the participants in training. Any acquired structure that is up for live fire training consideration must be prepared for the training evolution. Remember, NFPA 1403 states, "Buildings that cannot be made safe as required by this chapter shall not be utilized for interior live fire training evolutions."

Live Fire Tips

There is an old adage in the fire service, "We Train to Fight Fires—We Don't Fight Fires to Train."

Concerns that might immediately rule out a particular structure, or require significant mitigation, should be addressed at the initial visit to the site. Many of the initial observations can be done during the first visit if you take the time to walk in and around the structure. In no particular priority, some of these concerns may be as follows:

- Proximity to other structures and exposures, such as utilities, infrastructure, sheds, trees, and heavy vegetation on and adjacent to the property that could be in danger of fire spread.
- Adjacent properties that could adversely be affected by smoke produced during evolutions such as schools, childcare facilities, hospitals or nursing homes, or possible business disruptions. The owners of these properties need to be notified of the date and time of the planned training sessions, so that they can take the appropriate precautions.
- Adjacent properties where even the presence of fire and fire apparatus could be an issue, causing concern or disruption such as schools, childcare facilities, hospitals or nursing homes, or possible business disturbances.
- Locations where local transportation could be affected, such as busy streets, highways, railroads, or airports. These interruptions could be smoke obscuring a roadway, a railroad, interfering with airport operations, or secondary issues like traffic disruptions due to passers by "checking out the scene" of smoke and fire apparatus.
- Site access restrictions, and parking for apparatus and equipment.
- Obvious structural integrity, such as a sagging roof or floors, or cracks in brick or masonry walls.
- A structure that has already had a fire. This does not automatically preclude its use, but does require determining how much damage was sustained.

- Does the structure provide for the fire department's needs? What does the fire department and its fire fighters gain from burning the structure? Will the interior configuration allow the fire department to conduct the desired evolutions in a safe manner? Are hallways wide enough for operations? Are there "mantraps" or other hazardous features or fixtures?
- Other discernable issues and concerns such as past occupancy, or contamination to the building or site, either by construction materials or by other means.

Owner Responsibilities

Based on a favorable initial evaluation, the owner needs to be advised of his or her responsibilities and of the costs involved. Careful record keeping is extremely important at this stage and fire departments are encouraged to use checklists, such as the examples included in the appendix of this text. Make sure all of those documents are easily accessible and readily available at the site when conducting the exercises. It is very common for the environmental agency or other regulatory agencies to request copies of the documents, especially the permits and environmental inspections. The authority having jurisdiction (AHJ) will need to provide any permits or permissions to outside, contract, or other training agencies upon request. However, before the fire department spends any time or money on the project, the following needs to be definitively determined:

- Evidence of ownership and clear title.
- Proof of fire insurance cancellation, or a signed statement of the nonexistence of insurance.
- Written permission from the owner detailing what the fire department can or will do with the structure.
- A document signed by both parties that details the responsibility to obtain the necessary permits and inspections, the cost of asbestos removal, and any other environmentally prohibited materials or preparation costs. It is up to the fire department to determine if the donor or the fire department will bear the costs or share them. Beyond the requirements of NFPA 1403, many environmental agencies will require inspections and the removal of certain materials in a prescribed manner.
- A document signed by both parties with a very detailed description of the anticipated condition of the structure at the completion of the evolution(s). This needs to include which party will pay for any remaining demolition, the removal of debris, and the responsibility of securing the property until the site is considered safe. The attorney for the fire department may want this document to be formal, notarized, or otherwise executed.
- Plans for lunch and appropriate cold drinks for the participants can be organized with the property owners.

Preburn Plan

The preburn plan for an acquired structure needs to include details in addition to those common to a permanent training facility. The plan needs to be developed and approved by the instructor-in-charge, and then approved by the fire department's proper chain of command. This plan must include all features of the training structure and must also include the following:

- Prior to the beginning of evolutions, all participants, including the instructors, need to participate in a thorough walk-through of the acquired structure in order to understand the expected evolutions and to have a good understanding on the primary and emergency egress routes. Emergency procedures in the plan need to be reviewed with all participants.
- Final controlled burn plan, includes final check of building for personnel, equipment, conditions, PAR, and audible "burn down" signal to all personnel
- Demobilization plan (release of personnel, returning of equipment, placing fire apparatus back into service, etc.)
- Transfer of property back to owner

Emergency Plans

A training fire is unlike an emergency response. We can plan, gather personnel, layout equipment and hose lines, and tour the building before a planned fire starts. However, when working with an acquired structure, unexpected fire spread and other problems can occur. Unlike a fire in a permanent live fire training structure, in this case, the structure itself is actually on fire. The role of the rapid intervention crew (or local term for the same function) and the safety personnel, and purpose of the walk-through all become more critical.

Despite the weeks of planning leading up to a training exercise, fire is unpredictable and can still spread into voids, concealed spaces, and exit paths. Like a working structure fire, all personnel must be vigilant for such fire spread. When fire is discovered in any of these areas, training operations should cease, as the fire should now be treated as an uncontrolled fire. Planning must determine how unforeseeable emergencies like this will be handled. The backup hose line may take over suppression while recruits are relocated to the exterior. However, personnel need to know that operations have shifted from training to suppression. The instructor-in-charge needs to advise all personnel of the shift from training to suppression and get an acknowledgement of that shift, just like when shifting from offensive to defensive operations at a structure fire. NFPA 1403 requires that any time the instructor-in-charge determines that any condition represents a potential hazard, the training evolution shall be stopped immediately. If the fire acts in an unexpected manner for whatever reason, or problems are encountered with students, hose lines, water supply, or anything that threatens the safety of the participants, withdraw the personnel and resolve the situation. In certain situations, this will require careful analysis of the building in order to ensure it is safe to continue. Crews on the outside may need to be reassigned with new orders to extinguish the fire, until the building is assessed for safety. If the fire can be extinguished and the area made safe, sometimes ceilings can be secured and operations started again. Be very cautious with fires getting into attic and large void spaces, as this is a recurring problem in acquired structures.

If an evolution is stopped, it should only be restarted once the hazard identified has been resolved. The safety officer and any assistants need to confer with the instructor-in-charge and,

if in agreement, the evolution should only continue after the "Go/No Go" sequence is initiated.

Water Supply

When it comes to water supply for live fire training, instructors have varying opinions on how much water should be available, what the water source(s) need to be, and how to maintain the water. On top of this, there are many times when instructors get nervous over the idea that they must do calculations to determine the amount of water needed at an evolution. The intent of NFPA 1403 is to assure that training is conducted in a safe environment. This means that if the attack line should lose its ability to fight fire due to a mechanical or other emergency, the backup line must still have pressure and enough water to put out the fire and allow the attack team to escape safely

To this end, the instructor-in-charge is required to determine the amount of water needed for the live fire evolution as well as the amount needed for any unforeseen emergency. This requires that the instructor be able to determine the amount of water needed, identify the source of the water, and assure maintenance of the water supply for both attack and backup lines.

The instructor-in-charge shall determine the rate and duration of waterflow necessary for each individual live fire training evolution, including the water necessary for control and extinguishment of the training fire, the supply necessary for backup lines to protect personnel, and any water needed to protect exposed property. To determine the amount of water, NFPA 1403 refers the instructor to NFPA 1142, *Standard on Water Supplies for Suburban and Rural Firefighting*, which determines the minimum requirements for water supplies for structural firefighting. In areas where there is not a reliable municipal water resource, the instructor will need to be familiar with the water calculations in NFPA 1142. NFPA 1403 also requires a minimum reserve of additional water in the amount of 50 percent of the fire flow demand determined to handle exposure protection or unforeseen situations.

Determining the Required Water Supply

The **fire flow rate** is the amount of water pumped per minute (in gallons per minute or liters per minute) needed to extinguish a fire. The **minimum water supply requirement** is the total amount of water, not flow, required for a given structure based on its size, construction, and proximity to other exposures. In order to begin determining how much water will be needed, the instructor must know the occupancy hazard, type of construction, structure dimensions (length, width, and height), and any exposures that exist.

Remember that the fire flow rate and the minimum water supply needed for the evolution are two different calculations. For a nozzle that flows a minimum of 95 gallons per minute (gpm) (360 Liters per minute), which is the minimum allowed for live fire training, use the National Fire Academy's Fire Flow Rate formula, as follows:

$$\text{Fire flow rate} = (\text{FFR} \times (l \times w)) \div 3$$

Where: l = length of room/structure

w = width of room/structure

Per NFPA 1142, the minimum water supply (MWS) requirement formula is equal to the total volume (TV) of the structure divided by the Occupancy Hazard Classification (OHC) number multiplied by the Construction Classification (CC) number. If there is an exposure hazard (EH), the result is then multiplied by 1.5. This formula is expressed as follows:

$$\text{MWS} = (\text{TV} \div \text{OHC}) \times \text{CC} \times \text{EH}$$

The Occupancy Hazard Classification numbers and the Construction Classification numbers also come from NFPA 1142 and are as follows:

The **Occupancy Hazard Classification** numbers are a set of predetermined factors between 3 and 7 that represent the hazard levels of certain combustible materials.

Occupancy Hazard Classification:

3. **Severe hazard occupancies:** Explosives and pyrotechnics manufacturing and storage, flammable liquid spraying
4. **High hazard occupancies:** Warehouses, building materials storage, department stores, exhibition halls, auditoriums, theaters, upholstering with plastic foams
5. **Moderate:** Quantity or combustibility of contents is expected to develop moderate rates of spread and heat release
6. **Low:** Quantity or combustibility of contents is expected to develop relatively low rates of spread and heat release
7. **Light:** (Dwellings) Quantity or combustibility of contents is expected to develop relatively light rates of spread and heat release

The **Construction Classification** numbers are a set of predetermined factors between 0.5 and 1.5 that relate to the type of building construction of an acquired structure:

0.5 Type I Construction (Fire resistant)

0.75 Type II Construction not qualifying for Type I (Noncombustible)

1.0 Type III Construction: (Ordinary) exterior noncombustible or interior of wood

0.75 Type IV Construction: Heavy timber exterior and interior

1.5 Type V Construction (Wood frame)

As a rule of thumb and according to NFPA 1403, attack lines, backup lines, and rapid intervention crew hose lines should each be capable of flowing a minimum of 95 gpm (360 L/min), and two exposure lines should be capable of flowing 200 gpm (758 L/min) each. If all lines were operating at once, this would require a minimum of 700 gpm (2653 L/min). When calculating fire flow, all possible lines must be considered.

Water Supply Source

Now that the minimum water supply needs for the live fire evolution have been determined, the instructor needs to determine the source of the water. The instructor needs to consider water sources based on the location of the training. Rural water supply and urban water supply sources have different concerns, however the intent is to have reliable and valid separate water sources. When deciding the reliability of the water source, the instructor in charge needs to ask, "If my primary attack line water source is lost, or the pumper drafting should malfunction, will the backup line continue to have an adequate water source?"

If two pumpers are drafting from the same water source such as a river or pond, the instructor in charge must assure that there is enough water to supply both pumpers and both the attack and backup lines. If folding tanks are being used, two separate pumpers should be used to supply the attack and

Live Fire Tips

Example 1

A 1-story, wood-framed dwelling, measuring 20' × 20' × 10' (6.1 m × 6.1 m × 3.05 m), with a standard 4' (1.2 m) from attic floor to ridgepole and one exposure, requires what minimum water supply?

$$MWS = (TV \div OHC) \times CC \times EH$$

First calculate the total volume (TV) of the structure. This is done by multiplying length × width × height. For structures with a pitched roof, the height is equal to the wall height + half the height of the pitch. In this example, the height is 10' + (1/2 × 4') = 12'

$$TV = (20 \times 20 \times 12)$$
$$= 4800 \text{ ft}^3$$
$$OHC = 7 \text{ (light)}$$
$$CC = 1.5 \text{ (wood-framed)}$$
$$EH = 1.5$$

Therefore:

$$MWS = (4800 \div 7) \times 1.5 \times 1.5$$
$$= 685.7 \times 1.5 \times 1.5$$
$$= 1542.8 \text{ or } 1543 \text{ gallons}$$

Using these calculations, the minimum water supply needed is 1543 gallons, but in this case there is an exception. According to NFPA 1142, the minimum water supply required for any structure without exposure hazards is 2000 gallons (7570 L) and for structures with exposure hazards it is 3000 gallons (11,355 l). According to NFPA 1142, an exposure hazard is any structure within 50 ft (15.2 m) of another building and 100 ft² (9.3 m²) or larger in area. So in this case, the minimum water supply is 3000 gallons (11,355 L).

Now that the required minimum water supply has been calculated, what is the minimum fire flow rate (FFR) required for this structure?

$$FFR = (l \times w) \div 3$$
$$= (20 \times 20) \div 3$$
$$= 400 \div 3$$
$$= 133 \text{ gpm}$$

133 gallons per minute (8.4 L/sec) would be the minimum fire flow rate required for 100 percent involvement of the structure. Round down from 133 gpm to 125 gpm (7.9 L/sec) because of nozzle settings. If this example were of a two-story house, we would have to calculate an additional fire flow rate at 25 percent per floor up to 5 floors (see Example 2).

Live Fire Tips

Example 2

A 2-story, wood-frame dwelling is 50' × 24' (15.2 m × 7.3 m). Each story is 8' (2.4 m) high with a pitched roof that is 8' (2.4 m) from attic floor to ridgepole. What is the approximate minimum water supply (MWS) needed?

$$MWS = (TV \div OHC) \times CC$$

Calculate the total volume (TV) of the structure, which is equal to length × width × height. In this case, the height is equal to:

$$\text{height} = 8' + 8' + (1/2 \times 8')$$
$$= 8' + 8' + 4'$$
$$= 20'$$

$$TV = (50 \times 24 \times 20)$$
$$= 24{,}000 \text{ ft}^3$$
$$MWS = (24{,}000 \div 7) \times 1.5$$
$$= 3428.6 \times 1.5$$
$$= 5142.9 \text{ or } 5143 \text{ gallons}$$

The minimum water supply required for this structure is 5143 gallons (19,468 L).

What is the minimum fire flow rate (FFR) required for this structure?

$$FFR = (l \times w) \div 3$$
$$= (50 \times 24) \div 3$$
$$= 1200 \div 3$$
$$= 400 \text{ gpm}$$

400 gallons per minute (25.2 L/sec) would be the minimum fire flow rate required for 100 percent involvement of the structure, however since this is a 2-story house, we must add an additional 25 percent of the calculated FFR for each floor, up to 5 floors. Therefore:

$$FFR = 0.25 \times 400$$
$$= 100 \text{ gpm}$$
$$100 \text{ gpm} + 400 \text{ gpm} = 500 \text{ gpm total}$$

The total fire flow rate would be 500 gpm (31.5 L/sec) and the minimum water supply would be 5143 gallons (19,468 L).

Live Fire Tips

A technique that will assist with water supply and live fire training is to use different colored hoses to ensure that instructors and students know which lines support which function. For example, the attack line could be red, the backup line could be yellow, and the rapid intervention crew line could be green. If there is not enough colored hose to run from the engine, a different colored hose could be used at the nozzle only. There should be no confusion as to which line is being utilized for what function. The exposure lines should be clearly identified by divisions, as in exposure A/B, which would cover two sides of the structure, or exposure A and exposure C where each line is covering only one side of the structure.

backup lines. If possible, an added safety would be to have two dump tanks to supply the two pumpers. Regardless, the water source has to be enough, and two separate apparatus should be used to supply the lines.

If the training area is in an area with a municipal water source, the instructor needs to ask other questions such as, "If the main pipeline should rupture, are both hydrants affected?" and "Do municipal water sources have backup generators in case of loss of power?" If a municipal water supply system is used, two pumpers on two different hydrants should be used. This assures that should the attack line lose its water, the backup line should still have enough to protect the attack line and allow for escape. If the instructor-in-charge feels that there needs to be additional safety precautions, portable water tanks could be used at one of the hydrants or a pumper could be used to assure there is additional water source in an emergency.

Initial Preparation

After determining that a structure is usable, and the owner and fire department agree to terms, a more detailed inspection of the structure and property should be performed followed by preparation. The instructor-in-charge is responsible for ensuring the acquired structure is prepped to meet NFPA 1403. Although there is no rule or requirement that states this inspection be separate from the initial evaluation, it is often better to do so for organizational purposes.

Access

Access to the training site can be a problem, just as it can be in a hostile fire situation. However, unlike emergency responses, access to the training site can be planned for

- **Access to and from the training area:** Locate a staging area for apparatus and parking for other vehicles that will not be used on the immediate scene. Remember to locate an area for in-service apparatus that will be considered available for response, so that they do not get blocked by parked vehicles, hose lines, or spectators.
- **Access to the property:** Fences or walls that limit access to the site may have to be removed. Make sure to keep areas wide open for unexpected emergencies.
- **Access around the property:** Trees, brush, and surrounding vegetation that create a hazard to participants or limit access to the scene must cut back or removed. High grass and weeds need to be cut clear in the operations area so any hidden hazards can be exposed. These include toxic weeds, insect hives, or vermin that could present a potential hazard. This removal may require professional assistance, especially with large bee colonies and similar hazards.
- **Underground dangers:** Septic tanks or other buried tanks must be identified and clearly marked and/or barricaded to ensure apparatus do not park above underground tanks. Drain fields that the owner expects to reuse need to be avoided. Both fire fighters and fire apparatus have been known to fall into septic tanks. Mark areas to be avoided Figure 6-1.
- **Nonparticipant access:** The press, spectators, law enforcement, and emergency medical services (EMS) will all be present on the day of training. Be prepared for this influx of spectators and plan ahead of time for parking and the area from which they will observe.

Figure 6-1 Septic tanks and other hazards should be marked for safety.

Equipment and Supplies for Preparing the Building

Depending on the structure, and according to NFPA 1403, the following items are needed to prepare the structure:

- A fully equipped engine
- Hammers and nails
- Cordless drills, battery chargers, and screws
- Cordless saws, battery chargers, and blades
- Generator(s) and extension cords
- Portable lights
- Step ladders
- Round point and flat shovels
- Brooms
- Chain saws and proper fuel
- Vent saw and proper fuel
- Weed eaters
- Bolt cutters, wire cutters, and tin snips
- Premade vent opening covers
- Utility ropes
- Barrier tape
- Water flow test kit or pilot tube and gage
- Measuring wheel with pad of paper
- Four sheets of ¾" (19 mm) CDX grade plywood (to cover openings in attic spaces)
- Six 2" × 4" × 8" (50.8 mm × 101.6 mm × 2.4 m) wooden studs (to use as braces)
- Type X Gypsum wall board

Some training centers use large bins to keep forms, markers, accountability supplies, signage, plans, reports, and other materials that are needed for each burn, in good order and stored conveniently between uses Figure 6-2. Use a printed inventory of what should be in each bin. The bins are good for acquired structures or permanent live fire training structures.

Entry and Egress for the Structure

All entry and egress routes must be planned for ahead of time and must be known to all participants. These routes must also be monitored during the evolutions to ensure they are clear in the event of an emergency. In addition, the primary doorways must being clear for normal access. When unexpected problems arise, fire fighters should always have a short

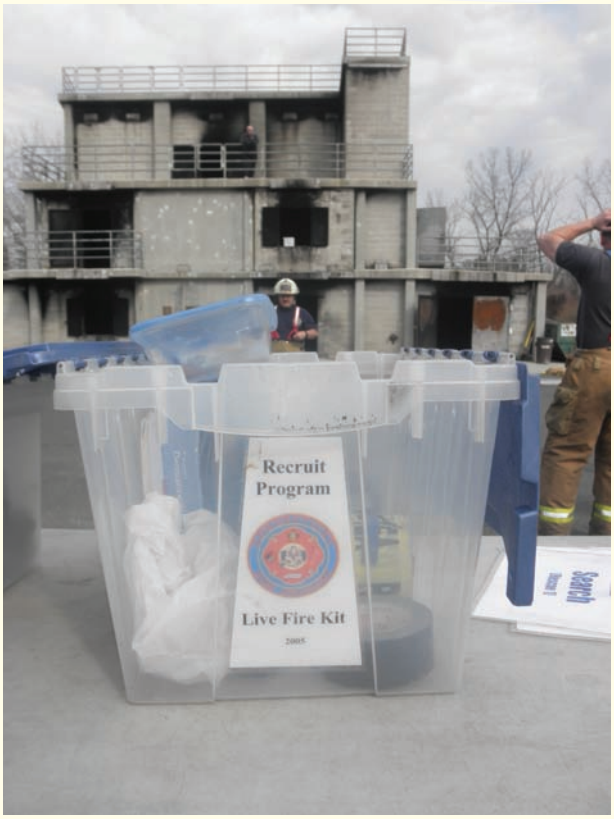

Figure 6-2 Large, plastic bins can be used to keep materials in order.

Figure 6-3 Hose hinges keep window coverings in place, but are easily knocked down.

travel distance to the outside. Likewise, instructors and rapid intervention crews (RIC) should be able to rapidly access the interior crews' status in a moment's notice. In selecting what rooms are to be used for the live burns, there must be at least two separate means of egress available for each room. Any room with limited access should not be used for live fire training purposes, unless a door can be cut out. Fires cannot be located in any exit paths, so that participants have a direct path to the outside.

The following are precautions to take when selecting rooms and preparing the structure for live fire training:

- Trees, brush, and surrounding vegetation that create a hazard to participants or limit entry and egress shall be removed.
- Interior and exterior doorways need to be easily accessible, with no obstructions, and no drop-offs that could cause injury. Locking mechanisms should be disabled or removed. Pneumatic or other types of door closers should be removed, as should storm doors, screen doors, and secondary security doors.
- Windows need to be easily accessible for emergency egress, and when windows are covered for the training evolutions, these coverings must be removable from inside or out by hand, without tools. Consider using hose hinges, or other methods Figure 6-3. Any glass, hardware, horizontal or vertical cross pieces, window air conditioners and fans, or anything else that could hinder a fire fighter from exiting should be removed. There must also be an exterior escape path that is not blocked by plants or other obstructions. If the window sill is high or is too small, cut the wall below it to make it accessible as an exit, if there are not sufficient means of egress for the evolution planned Figure 6-4.

Figure 6-4 A window can be made into a doorway by cutting and removing a section of the wall below the window.

- Make doors where needed. Sometimes long hallways or large rooms make for long escape routes. Keep escape routes short and clear, and cut through walls if needed.
- Stairs, porches, and railings need to be in serviceable condition and not hazardous to exiting fire fighters.

Exterior Preparation

Asphalt and Asbestos

In the initial assessment, the exterior was assessed for sagging or other visual signs of potential structural damage. Now the actual exterior surface covering must be evaluated. Although there are a number of environmental concerns, the most common concerns are asphalt and asbestos. Be sure to know the applicable requirements in your jurisdiction for permitting, testing, removing, and disposing of such substances. Most areas will have requirements for asbestos testing. Many homes and buildings built before 1985 will have asbestos either in the roofing, flooring, insulation around the heater and plumbing, or possibly in exterior or interior wall surfaces. Starting in the 1920s, the National Board of Fire Underwriters recommended that homeowners use asbestos siding and roofing instead of the less fire-resistant wood materials. By 1979, the US government outlawed the use of asbestos in many building products, because of its physiological effects on humans. This ban included asbestos cement siding shingles; however, they are still found in structures today.

Siding is generally not an issue, unless it is asphalt or asbestos. Composite siding made of asphalt-impregnated fiberboard, with the surface granules similar to asphalt roof shingles, was popular on less expensive wood-frame houses built before 1950. The asphalt siding often has a pattern that makes it look like stone or brick. Also, cement asbestos board was used for lap siding and wall shingles. Asphalt shingles, paper shingles, or tarpaper roofing will most often have to be removed due to environmental requirements. It is important to note that products containing asbestos cannot be identified by sight alone, and further testing may be needed.

Houses built before 1980 should be suspected of having asbestos. Asbestos can be found in many places in a building, such as on furnaces, boilers, hot water pipes, ceiling tiles, drywall, roofing felts and shingles, and exterior siding shingles.

Asbestos siding was manufactured in a wide range of colors and patterns, but it does have some characteristics that may help identify it. Asbestos siding shingles are usually 12" × 24" (304.8 mm × 609.6 mm). They may have grooves or a wood-grain pattern pressed into the cement, or they may be smooth. Each tile usually has two or three nail holes at the bottom of each shingle. Another popular type of asbestos siding came in 27 ½" (12.7 mm) corrugated sheets of various lengths. These sheets were used in the same way that corrugated metal sheeting was used. It can be recognized by the corrugation, but these sheets were seldom used in home construction.

Utilities

Once the building construction is secure and all measures have been taken to mitigate any dangers, the utilities must be secured. This requires going beyond the household or building service disconnects and shut-offs. There have been unfortunate experiences during live fire exercises where the electrical service lines going to the weather head were found to still be charged. Electrical service lines must be disconnected from the pole to the weather head Figure 6-5. Natural gas must also be shut off at the distribution line. In both cases, this disconnect must be done by the service provider, and that provider should be the point of contact if there are any questions. Liquid propane gas (LPG), fuel oil, and other such tanks must be moved away from the building. Any tank that cannot be removed must be rendered inert, most often by filling it with sand. In addition, tanks that cannot be removed shall be vented to prevent and explosion or rupture. Check with the service provider if any doubt exists.

Figure 6-5 Ensure that the electrical service lines are disconnected from the pole to the weather head.

Marking the Building

The sides of the building should be marked according to local protocol. This procedure is done to eliminate confusion and to reinforce the procedure with all of the participants. The accepted protocol is generally for the front of the building to be marked as side A, with sides B, C, and D designated in a clockwise fashion. However, there are local and regional variants, so you should check with the authority having jurisdiction Figure 6-6.

Ventilation

Roof ventilation is another aspect of exterior preparation that needs to be readied. This process will have to wait until the interior fire locations are finalized. Emergency ventilation must be planned for in order to limit fire spread and improve interior conditions. Neither the primary nor secondary egress points should be used for normal room ventilation. The ventilation

Figure 6-6 The sides of the building should be physically marked according to local protocol.

Figure 6-7 Roof ventilation openings are made during preparation, not during the actual fire. Hinges, pivot, and cable allow remote release from the ground.

opening must be placed in such a way as to draw the products of combustion *from the means of egress*, not towards the means of egress. This gives the fire fighters a way out while the products of combustion are drawn away from them. When deciding where to put the ventilation openings, keep in mind fire behavior, the layout of the building, the burn room(s), hallways, and the primary and secondary means of egress. Existing roof openings that are normally closed, but could be opened in the event of an emergency, can be utilized. The ventilation opening must be cut during the preparation stage and not while any live fire evolutions are taking place Figure 6-7. Do not place fire fighters on the roof during a live fire training evolution. A pivot point and cable can be used to secure the covering so that it can be opened and closed from the ground as needed.

Chimneys

Chimneys need to be checked for stability to make sure they will not fail during interior operations. Once the structure is compromised, it becomes more likely that the chimney will collapse, endangering personnel operating inside and outside. Apart from the collapse concern, chimneys can allow fire spread into attics and upper floors during house fires. Although this is an infrequent problem, it should be considered. Outside chimneys should be removed before training takes place.

Additional Hazards

Any toxic weeds, insect hives, or vermin that could present a hazard to fire fighters must also be removed from the area. The last part of exterior preparation should be to remove any exposures or combustible materials outside, including storage sheds, detached garages, and materials from demolition and such. These items must either be removed or protected from unintended ignition or fire spread.

Interior Preparation

Common Hazards

Most of the preparation efforts will be spent inside, as the interior will be where the majority of operations take place. Most often, buildings donated for live fire training purposes have not been occupied for some time. Some buildings may have been used by trespassers for shelter or for illicit use. Hazards from these nontraditional uses can be present in the form of drug paraphernalia, broken glass, weapons, and even infectious clothing or bedding. Caution should be exercised during the preparation stage to protect personnel from these hazards, as well as from unseen structural dangers. It is important to use personal protective equipment, especially safety shoes, helmets, gloves, eye protection, and if using power equipment, hearing protection, etc.

A systematic manner of preparation is necessary to accomplish the desired level of security. First and foremost, determine the building's utility status. Next, before interior preparation begins, check for environmental hazards, such as insects in or around the structure that could have an effect on the building's preparation, or the evolution itself. Environmental hazards include contamination from past storage in homes and in businesses. Some such contamination includes pesticides and other chemicals, depending on the building's previous use. Illegal drug manufacturing has become an issue in many areas, and the conditions associated with these locations can dangerously contaminate a structure. Unfortunately, with abandoned structures, vagrants or drug users may have occupied them and left behind biological issues in addition to dangerous drug paraphernalia, broken glass, and trash. It may be wise to include bio-hazard protection such as latex gloves, masks, bags, and needle containers. Even storage found in normal homes can provide for dangerous contamination from household pesticides, fertilizers, paints, and other materials. It may simply be safer to remove contaminated wood shelving or flooring. Businesses can be more difficult when it comes to environmental concerns, and it is important to determine what the building was previously used for. Consider checking past inspection reports and preburn plans.

One practice currently used is to spray the inside of the building with a bleach solution using a pump sprayer, starting from the farthest point from the exit and working towards the exit. This will kill off any insects and disinfect the area prior to removing any items. The suggested concentration is two cups

Near Miss REPORT

Report Number: 9-919
Date: 10/14/2009

Event Description: After completing four live burn evolutions in an acquired structure, a PPV fan was placed near the basement doors to vent the structure. All the evolutions were basement fires and were compliant with the requirements of NFPA 1403.

After ventilating for about 15 minutes, myself and a crew of two went into the structure to retrieve the metal drum and remove the 1-¾ hose that was the safety line for the ignition team. We had full structural gear without SCBA.

Once we entered the basement, we found the drum still burning and impinging onto the ceiling joists. Extinguishment was quickly made with the handline and we found no extension.

Lessons Learned: Decision-making and situational awareness are of utmost importance. The decision to remove the hose team without fully extinguishing the class A barrel could have led to an actual uncontrolled fire in the basement.

The safety officer and the instructor assigned to the basement both left without verifying extinguishment.

Lesson learned – make sure the fire is out before leaving.

of bleach per gallon of water (0.24 L of bleach to 3.785 L of water) in a sprayer. Be sure to use a mask when spraying the structure. Spray the structure one or two days prior to building preparation to allow for drying. Some other suggested solutions are as follows:

- 1 tablespoon of regular bleach per gallon of water, for Staph and *E.coli* .
- ¾ cup of bleach per gallon will kill Feline Par vovirus and Canine Parvovirus.
- 1 ¾ cup bleach per gallon will kill *Mycobacterium bovis* (Tuberculosis).

Furniture

Furniture needs to be removed during the interior preparation. It may be tempting to leave furniture in the structure that appears to be wood, but do so with great caution. Most furniture today is not made of solid wood, but rather pressboard with an exterior laminate to look like real wood. Only Class A materials with known burning characteristics may be used for the burn sets (materials to fuel the fire). Until recently, NFPA 1403 did not specifically prohibit the use of burning furniture, as it did the use of flammable or combustible liquids. Previous editions of NFPA 1403 required that the fuels utilized have known burning characteristics and be as controllable as possible. With furniture, it is not always feasible to determine the construction materials used. Many of the commonly used products give off considerably more heat, smoke, and toxins than would be expected.

Live Fire Tips

A bleach solution will kill the following:

- Bacteria: *Staphylococcus aureus* (Staph), *Salmonella choleraesuis, Pseudomonas aeruginosa*
- *Streptococcus pyogenes* (Strep), *E.coli, Shigella dysenteriae*
- Fungi: *Tricholphyton mentagrophytes* (causes athlete's foot), *Candida albicans* (a yeast)
- Viruses: Rhinovirus Type 37 (a type of virus that can cause colds), Influenza A, Hepatitis A virus
- Rotavirus, Respiratory Syncytial Virus (RSV), HIV-1, Herpes simplex Type 2, Rubella virus
- Adenopvirus Type 2, Cytomegalovirus

Safety Tips

During interior clean up, dust masks and eye protection are necessary. Hand protection is also strongly recommended when removing bedding, clothing, and similar items.

Safety Tips

Per NFPA 1403, ordinary combustibles such as clean wooden pallets, pine excelsior, and hay and straw not chemically treated are allowable fuels. Clean wooden pallets means that they are free from any noticeable spilled material that may have soaked into the wood such as oils, pesticides, or other material that may cause an unforeseen condition or create a hazard.

NFPA 1403 specifically prohibits the use of materials found on-site where the fire department cannot verify the environmental or health hazards associated with the materials, such as exposure to chemicals not readily apparent. Unknown chemicals pose dangers, not just in the obvious way of inhaled chemicals, but also through contact. An unknown contaminant can get on protective clothing and could be later inhaled or contacted. For this reason, unknown materials are prohibited, along with known materials such as pressure-treated wood, rubber, and plastics. Further, straw or hay that is known to be treated with pesticides or harmful chemicals is not allowed for the same concerns.

Flooring

After the furniture has been removed, the rugs, carpeting, padding, and tack strips can be removed. This will expose the structure's actual floor. All combustible material must be removed, especially linoleum, which is a solid petroleum product Figure 6-8. Once linoleum is heated, it can act like flammable liquid pouring on the floor. Sheet vinyl (including the backing or underlayment), vinyl tile, and vinyl adhesive may all contain asbestos and must be removed. Remember, personnel will be crawling inside of the structure, so broken glass, debris, carpet tacking strips, vinyl flooring thresholds, nails, and other sharp objects are all crawling hazards and need to be removed. Holes in the flooring can lead to unexpected fire spread. Any holes in the floors need to be covered in a manner that will not cause harm, and must be able to bear the weight of fire fighters. Openings in the floor or ceiling created because of equipment being removed or other renovations, should be evaluated for reducing structural stability.

Walls and Ceilings

Walls and ceilings need to be checked for low-density combustible fiberboard or other combustible interior finishes. Low-density combustible fiberboard has contributed to the deaths of many fire fighters, and was a major factor in fire spread in the fires at Our Lady of Angels School (Chicago, Illinois), Hartford Hospital (Hartford, Connecticut) and Opemiska Social Club (Chapais, Quebec). Be very careful with unconventional interior finishes such as burlap, carpeting, artificial turf, and other treatments as they may cause rapid fire spread and unexpected smoke production, along with greater toxicity. Ceiling fans and large light fixtures also need to be removed so that they do not fall on participants during live fire exercises. Any holes that may allow fire to travel into the concealed void spaces must be covered.

Windows and Doors

Windows, as previously mentioned, need to be available for emergency egress. Window openings can be covered to keep smoke in and control flame spread. Be careful not to seal the windows airtight, because this can inadvertently create flashover conditions. Depending on the size of the windows, a small space at the bottom of the window can be left open to allow for ventilation to reduce flashover concerns. A small opening can also be made at floor level to allow for the introduction of air. If using a chainsaw, the width of the chainsaw bar will work, and either a three- or four-sided opening should suffice.

Interior doors must also be made safe. Remove any hardware that may snag or catch on personal protective equipment (PPE) Figure 6-9. Either remove or secure doors that need to remain open. It is recommended to clearly mark doors

Figure 6-8 For safety, expose the structure's actual floor by removing all additional layers of flooring.

Figure 6-9 Any hardware that may snag or catch on PPE must be removed.

that are not exits, such as closets or bathrooms without usable windows, and consider covering them so that a fire fighter under adverse conditions is not confused by the door frame and door Figure 6-10.

Kitchens

Cabinets and kitchen appliances are considered fixed contents and their removal will vary depending on what they are made of. Some live fire training instructors may want to leave in kitchen cabinets or bathroom cabinets for the live fire evolution. Depending on whether they are solid wood or composite-board, a burn test may be needed to determine the burn characteristics. If in doubt of the type of material, it is always best to remove it.

Commercial fixtures, such as large coolers or freezers, warrant careful review. Such commercial fixtures also frequently have large voids behind or around them to allow a service person to access them for repair. Such voids need to be considered. Closed containers, including water heaters and air conditioner compressors need to either be vented or removed Figure 6-11. Cans of products, especially aerosol cans and smaller items, need to be removed.

Oil Tanks

Oil tanks and similar closed vessels that cannot be removed from the structure must be vented to prevent an explosion or overpressure rupture. Enforce strict safety practices when ventilating these tanks. Also, any hazardous or combustible atmosphere within the tank or vessel shall be rendered inert to prevent an unexpected explosion. All hazardous structural conditions shall be removed or repaired so as to not present a safety problem during use of the structure for live fire training evolutions.

Attics

The attic space needs to be inspected for hazardous contents. Air handlers, hot water heaters, gas heaters, storage, and other items could be a collapse hazard and some items could contribute to fireload or adverse conditions. The attic space should be accessible so that a fire could be controlled with ventilation during evolutions, if necessary. Place a piece of plywood over the opening on the ceiling and on the roof, securing them both just enough to hold them in place so that they may be removed when needed. Determination of when to open the space will depend on the layout of the building, the burn room, hallways, and the primary means of egress.

Figure 6-10 Clearly mark doors that cannot be used as exits.

Live Fire Tips

A wood-frame house with lightweight truss construction was going to be used for a live fire exercise. When personnel checked the attic nothing was found amiss, but the safety officer noticed a wall covered in drywall that was set back about ten feet from the opening. Climbing into the attic, the safety officer found a full 200-gallon (757-liter) water tank that had been used when the house had solar panels. The tank had a weight hazard of over 1600 pounds (726 kg) and was situated directly over the hallway, which was the main egress for the burn rooms.

No matter how experienced or how many times instructors prepare a structure, when in any instructional or leadership position, do not take it for granted that everything has been done properly. Never assume!

Safety Tips

Weight above the training area can include contents on the floors above the fire, and on the roof. Anything that poses a potential hazard to participants needs to be removed.

Figure 6-11 Vent or remove closed containers that could rupture when heated.

Figure 6-12 Fluorescent spray paint can be used to mark the way out.

Live Fire Tips

Variables leading to flashover:

1. The heat release characteristics of materials used as primary fuels
2. The preheating of combustibles
3. The combustibility of wall and ceiling materials
4. The room's size and geometry (e.g., ceiling height, openings to rooms)
5. The arrangement of the initial materials to be ignited, particularly the proximity to walls and ceilings
6. The size and location of ventilation openings, both exterior and interior

Exits

Primary exits and exit routes need to be clearly marked and evaluated before each live burn. There are various ways to show exit routes, including the use of a light rope (illuminated rope-like cord), a strobe light, or other light at the primary exit point. Bright fluorescent paint on the floor can also help indicate the way out Figure 6-12. Some live fire training instructors suggest marking the exit pathways at baseboard level or on the floor next to the wall area to prevent the paint from being worn off by crews crawling with hose lines. Participants in the training evolution need to be made aware of the exits and any markings used prior to each evolution.

Stairs and railings must be made safe. Any broken or missing trends need to be replaced, the stairs must be clear of trip hazards, and the weight-bearing capability must be checked. The handrails and balusters also need to be secure.

Burn Locations and Fuel Loads

Each burn room must be prepared using Class A materials only Only one burn room can be used at a time, and only one fire set is allowed per room. Identifying the exact burn locations is critical in the preparation of the interior. The final burn locations are decided by the instructor-in-charge and safety officer.

The instructor-in-charge shall document the fuel loading, including all of the following:

- Furnishings
- Wall and floor coverings and ceiling materials
- Type of construction of the structure, including type of roof and combustible void spaces
- Dimensions of the room

Using all of the information above, the instructor-in-charge needs to carefully evaluate each fire room and burn location. The instructor-in-charge must check for factors that can affect the growth, development, and spread of fire. The instructor-in-charge must also evaluate for flashover danger and must map out the anticipated fire spread.

An excessive fuel load can help to create unusually dangerous fire behavior. When preparing the burn rooms, use only what is necessary to meet the training objectives and avoid conditions that could cause a flashover or backdraft. In several training incidents that resulted in injury or death, those running the drill did not anticipate flashover or unexpected fire spread based on the amount of fuel being used.

To avoid such tragedies, specify the fuel loading precautions during the planning stage. This should include the number of pallets to be burned, how much hay or excelsior to be initially used, and how much burn material can be added to the fire and when.

To save time, the pallets can be positioned at the burn set locations during the preparation of the interior. Hay or excelsior should be placed in the burn sets on the day of the evolution, especially if the structure is not secure. You do not want an intruder lighting the fires early. Also remember that you do not want the spare pallets and hay to become interior exposures and allow fire to spread to them. All other possible sources of ignition need to be removed from the operations area, except for those under the immediate supervision of the ignition officer.

Considerations for locating the exact burn locations include plotting the expected avenues of fire spread and the timefactors for expected build-up of the fire. Carefully analyze the room's characteristics, ventilation, and openings in order to plot anticipated and "worst case" fire spread. Ventilation must be planned. Do not place the fire fighters between the fire and the ventilation opening because the fire may travel towards them. Remember that if the entry door is theonly source of naturalventilation for the fire, there is a possibility that the fire will engulf the participants when it is in need of fresh air. Openings and voids within the structure can result in sudden and unexpected vertical fire spread and can trap participants by cutting off exit routes. Even worse, this fire spread can result in the unexpected weakening of the structure, which can lead to collapse. The instructor-in-charge and the safety officer need to ensure that the plans for primary and secondary exit paths do not conflict with the expected avenues of fire spread.

Burn Set

The burn set should be physically located in a corner of the room. This will vary based on where the fire stream will be directed into the room. Try not to place the burn set directly across from the door where the nozzle will be operating from, as it tends to allow personnel to operate from the hallway and not enter the room, and does not utilize the space in the room efficiently. Also, the burn set cannot be located in any designated exit path.

Lining the Room

There are several ways to extend the use of the rooms used for the live fire evolutions. One way is to "line" the room with an additional layer of dry wall for greater fire resistance. Another method is to use a "fire box" hearth. Both of these methods can also be used together.

To line the room, attach 5/8" (15.9 mm) Type X Gypsum wall board to the ceiling and walls adjacent to where the fire set will be. Type X Gypsum wall board has great fire resistance rating, and noncombustible fibers are added to the wall board to maintain greater strength and greater resistance to heat transfer during fire exposure. Put the covering on the ceiling first and then the walls, in order to provide a better seal and prevent fire spread into the attic area Figure 6-13. Taping and "mudding" the drywall can extend its use even longer.

Hearths or fireboxes can also be used in conjunction with a "lined room," or by themselves Figure 6-14. Hearths are metal and are used to protect the ceiling and walls from direct flame. They can be used during initial burns and then removed. There is a good chance that they may not be recovered, but when used with or without the drywall lining, they can be an effective way to provide for more evolutions in a single room.

Preparing the Neighborhood

It is important to be aware of the homes and businesses in the areas surrounding the training site. Properties adjacent to the burn site that could be affected by smoke or fire were identified in the initial evaluation. The owners of those identified properties need to be informed of the dates and times of the training evolutions, and any problems will need to be addressed at this time. Signs should be in place to advise people of the training session, and smoke advisory signs should also be posted. Traffic assistance from law enforcement may be necessary and should be planned for in advance.

Neighbors should be treated with courtesy and respect. Be sure to apologize for any inconveniences and try to answer all questions, to ease concern. A little planning can go far with neighborly relations. Set up a viewing area for them and let them tour the site before the fire. Explain all tasks at hand and what they should expect during the training. Make sure they know the following:

- Keep animals away.
- Close windows and shut off air conditioners.
- Bring in laundry from outside.
- Park vehicles inside the garage.

Spectators

Any live fire training evolution will inevitably draw spectators. Planning for the training must include spectator parking and the designation of spectator areas. Fire lines and warning signs need to be used to keep any pedestrians clear of the operations area, also known as the hot zone. These lines may need to be staffed for enforcement. All spectators need to be kept away from operations, where they can be hurt or get in the way. Some spectators may

Figure 6-13 Greater fire resistance can be added by lining the burn room with drywall.

Figure 6-14 Hearths or fireboxes can protect the ceiling to allow for more live fire evolutions.

Live Fire Tips

The locations of the burn sets should be all of the following:

- Determined by the instructor-in-charge with input from the safety officer and senior instructors
- With due regard to preventing flashover and fire spread
- The burn set cannot be located in any primary or secondary designated exit path.

Figure 6-15 Escort members of the media to a location outside of the operations area where they will have a view of the action and remain safe.

use cameras or video recorders, so the training session must be conducted in a professional manner. This may warrant a small reminder to the participants about proper conduct.

Media

The media will oftentimes be present and a viewing area must be established ahead of time Figure 6-15. Reporters should not be allowed in a structure during an actual fire. NFPA 1403 requires visitors allowed within the operations area perimeter to be escorted at all times. It also mandates that they should be equipped with and properly wear complete protective clothing.

Live Fire Training Evolution Preparation

After the initial preparation of the acquired structure, there are steps that still must be taken before conducting a live fire training evolution. The actions taken or not taken during this phase will decide the outcome of the training evolutions. Will it be a rewarding and organized training evolution or is it set up for failure from the start?

Equipment and Supplies

At a minimum, the equipment needed on the day of burn should include the following:

- Two fully equipped pumpers
- Sufficient portable radios with spare batteries and chargers for each crew, instructor position, etc. Include spares.
- Portable generator(s) with extension cords and surge suppressors (for radio chargers, cooling fans, lights, etc.)
- Accountability boards (command, entry, divisions/groups)
- Supplies to support local accountability procedures, such as personnel accountability tags, unit identification pads, Velcro, permanent markers, grease pencils, tape writer, razor knife or scissors, etc.
- Incident command vests
- Igniter (propane)
- Spray paint (a fluorescent color is recommended for interior painting)
- Two anemometers (wind speed meters) for command and rehab
- Thermal imaging camera(s)
- Four instant-up canopies (command, entry, rehab/medical, staging)
- Folding tables
- Folding chairs
- Six or more water coolers (command, entry, rehab/medical (3), and staging), depending on the weather. Participants should be encouraged to bring their own water as well.
- Two basic life support (BLS) kits including blood pressure cuff, stethoscope, tympanic thermometer, trauma dressings, burn sheets, and any other additional BLS supplies
- Automated external defibrillator(s)
- Documentation folder, containing:
  - Copy of NFPA 1403
  - Copy of model SOG/SOP
  - Copy of National Weather Service point forecast
- Copy of the preburn plan inclusive of the site plan, floor plan, communication plan, evacuation plan, medical plan, and demobilization plan
- Appropriate blank and executed forms
- Optional equipment:
  - Video and still cameras
  - Binoculars
  - Stopwatch
  - Scene tape to mark the operations area (the area where PPE is required), and the fire scene, which is the wide area surrounding the area of operations, in which no unauthorized personnel are allowed.
  - Traffic advisory signs, cones, and barricades; the local public works department can be a good resource.

Preparing for Ignition

The ignition officer must work in very close concert with the safety officer and instructor-in-charge to ensure that the learning objectives of the training evolution are met. Significant time and effort have been expended thus far, so it is very important that the ignition officer follow the proper order of operations, and not deviate from the plan regarding fuel loading, burn set locations, or safety protocols.

As previously mentioned, use only Class A materials with known burn characteristics in the burn sets. Class A materials include hay, excelsior, baled cardboard, and clean wooden pallets. Any unidentified materials that could burn in unexpected ways, or could create health or environmental issues shall not be used. Pressure-treated wood, rubber, and plastic are also not allowed to be used.

Much of the cardboard in use today has a wax coating to repel water and will burn differently than plain cardboard. This could hinder the ability to put the fire set out completely, and therefore, cardboard should be used with caution. Remember, only one fire at a time in an acquired building.

Excelsior is a product made of wood slivers that is used in packaging, cushioning, and in stuffed animals. Excelsior will act somewhat like hay when burned, but will give off more British thermal units (Btu) as compared to the same

amount of hay. A British thermal unit is a unit of energy, that is approximately the amount of energy needed to heat 1 pound of water, 1 degree Fahrenheit. Because excelsior has different properties than hay, you should practice first to determine the amount needed. This should always be done prior to and outside of the acquired building. Once again, it is necessary to know the burn characteristics of the materials being used.

Hay is usually the easiest to use when preparing a burn set. Clean, dry, feed-grade hay should always be used in order to limit the presence of herbicides and pesticides in the hay. A half a bale of hay is normally sufficient in most burn sets.

A maximum of five wooden pallets should be used with half a bale of hay. This should be sufficient for rooms that are approximately 10' × 10' (3 m × 3 m) or larger. Smaller rooms may only require a quarter or a third of a bale of hay with only three or four wooden pallets. One pallet should be set on the floor and two on each side leaning into each other to form a triangle, leaving an opening in the middle for the hay. Figure 6-16. Short legs made of 2" × 4" (51 mm × 102 mm) blocks can be added to lift the bottom pallet anywhere from 6" to 12" (152 mm to 305 mm) off of the floor. This may allow for better air circulation.

The hay should not be placed into the burn sets until the day of the live fire training evolution. When putting the hay into the burn set, fluff it by pulling it apart from the bale, making sure it is not compressed. This will make for proper burning. Bunches of hay haphazardly placed in the burn set does not work, because it does not allow for proper air circulation.

Figure 6-16 One method for configuring the burn set is to lean two pallets against each other, forming a triangle, and place hay or excelsior in the middle.

Safety Tips

Only one fire at a time in acquired structures!

Operations

Setup

Setup according to the site plan unless conditions, such as changing wind direction, dictate a change. A change in wind direction or force can postpone an exercise when smoke or heat could affect exposures. Any deviation from the plan *must* be included in the briefing of the instructors and participants.

Preburn Briefing and Walk-through

A preburn briefing and a walk-through of the structure are required prior to any thought of igniting the burn set. The instructor-in-charge and safety officer conduct the walk-through with all of the instructors and students. It may be necessary to demonstrate an evolution if there is any question of how something is to be performed, or to give clarity to the instructions. Two separate walk-throughs should be conducted, first with the instructors and then with the students. All instructors must have a clear understanding of the objectives for the evolution. If a room and contents fire is planned with fire being allowed to come out of the room, not to exceed four to six feet (1.2 m to 1.8 m), then there should not be flames engulfing the entire structure or traveling down a hallway for 10 to 15 feet (3 m to 4.6 m). Part of the preburn briefing is to point out the burn sets, sequence of burns, and the burn order of the rooms with the rooms numbered. Exit markings, ventilation points, and the primary and secondary means of egress should all be addressed at this time. All participants need to know the operations area where all PPE is to be worn and the fireground (warm zone) where a minimum of a helmet only may be required.

Go/No-Go

Prior to the safety officer giving a "go" in the Go/No Go sequence, he or she must inspect the structure to make sure it is clear of any occupants, unauthorized persons, animals, or objects. The possibility of vagrants being found in buildings always exists, even after the structure is prepared for burning. Ensure that the participants, students, and instructors are ready. This includes a check of all protective clothing and breathing apparatus.

Safety Officer

After the safety officer advises a "go," the instructor-in-charge should declare, "We have a go for ignition." The ignition officer would ignite under the supervision of the safety officer with a hose line in for protection. NFPA 1403 does not allow a student to be the ignition officer. This position needs to be filled by an experienced live fire instructor or under the immediate supervision of one.

In all situations there must be one safety officer, but especially in acquired structures, that position may need "deputy" safety officers to do the following:

- Monitor the entry point, ensuring a head count on all participants is done upon entry and exit. This must include instructors, other safety personnel, ignition officer, etc.
- Monitor interior participants for safe entry and egress.

- Monitor fire conditions between entry crews (reminder: nobody operates alone inside).
- Monitor structural conditions inside and out, watching for fire spread, changes in smoke production, structural integrity, etc. Provide visual monitoring for areas outside the safety officer's field of vision.

Igniting the Fire

The decision to ignite the training fire is made by the instructor-in-charge in coordination with the safety officer, and should follow the Go/No Go sequence. The fire is then physically lit by the ignition officer with the safety officer and a charged hoseline present. The ignition officer and all personnel inside during the ignition process must wear full protective clothing, including SCBA. If there are any other possible sources of ignition, other than what is being watched and used by the ignition officer, those sources must be removed from the operations area immediately.

In actual practice, often the instructor-in-charge and the safety officer will check the room and the fuel loading and arrangement before the training starts and in between burns, but the main safety officer will be outside at the time of ignition. This is where the "assistant" or "deputy" safety officers come into play. Remember that no one should be alone inside, including the ignition officer.

The actual ignition of the burn sets can be done in several ways. Many training agencies use propane torches, which generally result in an easy ignition Figure 6-17. If using propane torches, the ignition officer is responsible for removing the torch from the structure after ignition.

Road flares also work well for ignition, but caution should be taken as these flares work by burning metal powder that may drip and lead to additional ignition sites. If you use a road flare, the remaining flare should be removed from the structure and properly extinguished.

Fire Behavior Considerations

Reports by the National Institute for Occupational Safety and Health (NIOSH) and other agencies that have investigated injury and fatal training fires, indicate that not recognizing changes in fire conditions has been a common issue.

Fire behavior, and the many aspects it covers, is often overlooked. The ignition temperature of the materials, the amount of heat given off for the volume of material burning (or anticipated to burn), the arrangement of the materials, the amount of fuel compared to the size of the room, the geometry of the room, natural ventilation pathways, the amount of water needed to absorb the heat, the impact of radiant heat, the combustible gases in the smoke being produced, and the flashpoint for that smoke during the fire, are all considerations.

Issues with using furniture and other materials made of synthetics include the increased amount of heat given off, the increased amount of combustible gases with lower ignition temperatures given off, and the greater amounts of toxic chemicals released in the air.

Carbon monoxide is the most prevalent by-product of combustion, and has a relatively low ignition temperature (approximately 1148°F [620°C]), and is considered highly toxic.

Figure 6-17 A propane torch can be used for interior ignition.

Live Fire Tips

Remember:

- Ignition will only begin with the approval of the instructor-in-charge in coordination with the safety officer following the Go/No Go sequence.
- Only one fire at a time shall be permitted within an acquired structure.
- Fires shall not be located in any designated exit paths.
- Fuel materials shall be used only in the amounts necessary to create the desired fire size.
- The fuel load shall be limited to avoid conditions that could cause a flashover or backdraft.
- No unidentified materials, such as debris found in or around the structure will be used as they could burn in unanticipated ways, or create environmental or health hazards.
- No pressure-treated wood, rubber, or plastic should be burned.
- No flammable or combustible liquids should be used to assist ignition.
- Wooden pallets must be clean from any spilled material that may have soaked into the wood such as oils, pesticides, or other material that may cause an unforeseen condition or create a hazard.
- Hay needs to be dry, clean, and feed-grade to prevent using hay that has been subjected to pesticides or other unknown material.
- Nobody operates inside alone.
- Watch for debris from pallets and other materials that may hinder the access or egress of fire fighters, and be sure to remove it prior to the beginning of the next training exercises.
- Any time the instructor-in-charge determines that fuel, fire, or any other condition represents a potential hazard, the training evolution shall be stopped immediately. If an exercise is stopped, it should only be restarted once the hazard identified has been resolved and after the Go/No Go sequence.

Incident Report

Baltimore, Maryland - 2007

Figure A Baltimore floor plan. Note fire locations.

The Baltimore City Fire Department was conducting a live fire training exercise in a row house following the department's Fire Fighter I program. The program had not been successfully completed by all participants, and some of the recruits did not successfully complete the physical performance requirements during training. Some of the recruits had also never participated in interior live fire training evolutions.

The involved building was a three-story row house, and was one of a series of very narrow row houses, only 11'4" (3.5 m) wide. It was a 1200 ft^2 (111.5 m^2) unit, built as a single family home. It had been vacant for almost seven years, and condemned for three years. Each unit had separate exterior walls and the side walls touched on one or two sides of the adjacent unit(s). The units were trapezoidal in shape, and this was an end unit **(Figure A)**.

The live fire exercise consisted of multiple fires on all floors. The investigation indicates that approximately 11 bales of excelsior and at least 10 wooden pallets were used for the fires. Pallets were propped against the walls in several locations, with excelsior underneath. Excelsior was also placed in openings in the ceilings and in walls. In the backroom on the first floor, an automotive tire, two full-size mattresses, one twin-size mattress, one foam rubber chair, tree branches, and other debris were piled up and burned. The exact number of fires set could not be definitely determined, but there were at least nine separate fires.

It appears that the ignition of the fires was not coordinated with the preparation of students entering. Several students were not ready when the fires were ignited, and that allowed the fires to burn unimpeded while crews made final preparations to enter.

Five separate crews were to operate simultaneously as engine and truck companies. A sixth crew was designated as the rapid intervention crew (RIC), but they were not briefed and did not have a hose line.

An adjunct instructor and four students of the first crew, designated as Engine 1, entered through the front door. All of the students had PASS devices, but the adjunct instructor did not, nor did he have a portable radio. Per the direction of the instructor-in-charge, Engine 1 proceeded to the third floor and expected a second hose line to follow. They advanced an initially uncharged 1¾" (44 mm) hose line to the centrally located stairs on the first floor. There is disagreement as to when the line was actually charged.

Another crew of recruits was to advance a hose line to the second floor from the rear door. When they entered the rear of the house, they encountered the large pile of debris burning, which inhibited ingress and egress. The fire was spreading across the ceiling, and they extinguished the fire before a delayed advance to the second floor. As with the first crew, the four students had PASS devices, the adjunct instructor did not, nor did he have a portable radio.

The Engine 1 crew advanced to the second floor and encountered heavy fire conditions. Although directed to go to the third floor, the instructor determined it was necessary to knock down the fire before proceeding upstairs to the third floor. Two of the crew's members stayed on the landing between the second and third floors to pull hose, as the remainder of the crew advanced upstairs. Conditions on the third floor became too hot and the instructor did not have a radio to advise command of their situation or of interior conditions. The instructor lifted himself up and climbed out of a high window onto the back roof of the second floor. The first student was able to lift her upper body out of the

window. The instructor then grabbed her SCBA straps to pull her out the rest of the way onto the second floor roof. She was then hoisted to the third floor roof by Truck 3, where she told them that her crew needed help.

The other student was now at the window as the instructor attempted to pull her through, using her SCBA harness as he had done with the other fire fighter. She was initially able to talk to the instructor to tell him that she could not help, and that she was burning up. It appears that she still had her SCBA face mask on at this time. The instructor lost his grip and she fell back into the room, landing on her feet. When he was able to get hold of her again, she was still conscious but her mask was partially dislodged or removed. Her face had visibly started to blister. The instructor did not have a radio, but yelled for help. He lost his grip on her a second time and she fell back into the room. Shortly after regaining his grip on her for the third time, she became unresponsive. At this point, the crew jumped about six feet down from the third floor roof to help pull her out, but they were unable.

With additional assistance they were eventually able to help lift her onto the roof where a student used a portable radio to advise of the fire fighter down.

Assistance was requested of on-duty battalion, engine, and truck units that had come by to watch. The engine company engaged the fire, while the truck company entered to ensure that the students were all out.

Two members of the on-duty truck company climbed the aerial ladder to the roof and assisted in placing the victim in a Stokes Basket and carried her down the ladder. An advanced life support ambulance initiated advanced life support and transported her to a shock trauma center, where her care continued until she was pronounced dead.

Incident Report

Baltimore, Maryland - 2007

Post-Incident Analysis — Baltimore, Maryland

NFPA 1403 Noncompliant

NOTE: Near total lack of compliance to NFPA 1403. 50 issues considered to be violations of NFPA 1403 by investigative team.

- Flashover and fire spread unexpected (*4.3.7*)
- Walk-through was not performed (*4.2.25.4*)
- Multiple fires on different floors (*4.4.15*)
- Excessive fuel loading (*4.3.5*)
- Fire was beyond the training and experience of the students to participate in live burn exercises in an acquired structure (*4.1.1*)
- No incident safety officer (*4.4.1*)
- Noncompliant gear on victim. (*4.4.18.2*)
- Instructors without PASS* (*4.4.18.5*)
- Instructors not equipped with portable radios (*4.4.9*)
- Adjunct instructors had little to no prior instructional experience (*4.5.1*)

NFPA 1403 Compliant

- 22 Students, 11 instructors (*4.5.2*)
- EMS (ALS transport) on standby on scene (*4.4.11*)

Other Contributing Factors

- Students not informed of emergency plans/procedures
- Rapid intervention crew staffed by students and unequipped or prepared

Flashover

An instructor must be able r ecognize the signs of flashover and take appr opriate action. Some war ning signs of flashover, like "fingers of flame" or "daggers of flame" may not be visible or noticed without vigilance. Rapid heat build-up forcing the fire fighters lower and lower, coupled with dark, black smoke that banks to the fl oor, is one indicator of an impending flashover. When these fire conditions exist, action must be taken immediately. This includes the following:

1. Ventilate to prevent the build-up of super-heated gases.
2. Apply short bursts of water to cool the gases at the ceiling. Be sure to not disrupt the thermal balance!
3. If conditions do not immediately improve, it is time to exit the structure.
4. When water is applied to the ar ea without immediate results, it is time to exit the structure.

There may not be much time, so the decision must be made quickly to get the participants out of the structure. Once everyone is outside and accounted for, regroup and get the fire under control. As we know fire is an ever-changing phenomenon as it moves through its various stages of development. Interior instructors as well as those on the outside must constantly monitor for these ever-changing conditions.

inal Controlled Burn

After the interior evolutions are complete, and prior to the aquired structure being burned completely down, the fire must be brought under total control. This means putting all of the fire out. This allows for an orderly personnel accountability report (PAR) process, to ensure everyone is accounted for This is also the time to check the interior for tools or equipment, reposition hose lines for defensive operations, break for rehab, and start stowing equipment that will not be used during the burn down.

During this phase, there is a tendency to dr op some of the precautionary procedures utilized earlier during interior suppression operations. Personnel are tired, and it may be getting late, so it must be stressed to remain vigilant.

Great caution must be exercised in the preparation for the "final burn down." Walls and ceilings can be breached to allow for fire spread and fuel loading can be heavy. Positive pressure ventilation (PPV) fans can be employed to "push" fire throughout a building by what would be improper placement and use during a hostile fire.

Staffed, charged hose lines and a rapid inter vention crew need to be in place to protect personnel preparing for the final ignition. The incident management structur e needs to be fully in place. The final controlled burn should only begin after a completed Go/No Go sequence is done following all of the previously discussed guidelines. Prior to ignition, a pre-established "final burn down" signal, other than the emergency evacuation signal, should be sounded. This may be accomplished by one long horn blast or by a radio transmission. Everyone must be advised of this being the final burn down.

In the unusual scenario that that the building will not be burned down after training, plans for the immediate demolition of the structure should be in place. If for some reason the building will not be immediately demolished, the building will need to be checked to verify the fire is totally extinguished so there is not a rekindle. The site may also need to be secured from unwanted persons.

Safety Tips

Any time the instructor-in-charge determines that fuel, fire, or any other condition represents a potential hazard, the training exercise shall be stopped immediately. If an evolution is stopped, it should only be restarted after the Go/No Go sequence, once the hazard identified has been resolved.

Overhaul

The structure needs to be reevaluated after the final burn down, to determine what measures need to take place to render the site safe. Metal roofing, chimneys, large beams, and parts of walls that remain could be dangerous to children or scavengers. Arrangements need to be made for heavy equipment to knock over remaining walls or chimneys, and to make the site safe.

It should be expected that scavengers will want to go through the debris to collect salvageable metals and materials, and the curious will want to explore the remains. Signs and barrier or scene tape can warn adults of the danger, but younger children may not understand the warning signs or the danger present. The added step of installing construction or barrier fencing will protect the property owner and the fire department until the debris is removed. Often local government will have the fencing that they use on-hand for large events and construction projects, or it can be included in the agreement with the property owner that they provide it. It is even available for rental.

Postevolution Debriefing

Once the burn down phase and overhaul are completed, conduct a postevolution debriefing. The postevolution debriefing will help those in charge learn if anything could have been done better. Encourage all participants to give their input. Even though everybody will probably be tired, it is best to take get this information while it is still fresh in their minds.

Before leaving the site, the fire department needs to be careful not to leave burning debris that could cause fire or smoke problems to neighbors. If there is any doubt, it may be necessary to leave a fire watch in place. At this point, the structur e is turned back over to the property owner with a signed transfer of authority form.

Wrap-Up

Ready for Review

- The instructor-in-charge needs to identify whether or not the proposed acquired structure will fit the department's training needs.
- A preburn plan must be utilized with all live fire training, including acquired structures.
- Developing an emergency plan will help ensure the safest training.
- The instructor-in-charge is required to determine the amount of water needed for the live fire evolution as well as the amount needed for any unforeseen emergency. NFPA 1142, *Standard on Water Supplies for Suburban and Rural Firefighting*, should be consulted.
- Once a location is finalized, check with the authority having jurisdiction for what paperwork needs to be completed.
- An initial preparation should be performed to check the property itself, surrounding properties that may be affected, access to the structure, and any other dangers that may exist.
- All entry and egress routes must be planned for and made clear to all participants.
- Preparation of the exterior should including items such as assessing for any remaining structural damage, checking for asbestos, ensuring utility shut-off, determining roof ventilation, chimney removal, toxic materials, and weed removal.
- Most of the preparation will be spent on the inside with tasks such as mitigating environmental dangers, spraying for insects and diseases, removing furniture, removing flooring, preparing the windows, eliminating snag hazards, etc.
- It is important to be aware of the homes and businesses in the areas surrounding the training site. Notify the owners of those about the dates and times of the evolutions, and address any issues or concerns at that time.
- Use only Class A materials with known burn characteristics in the burn sets for live fire training evolutions with acquired structures.
- The decision to ignite the training fire shall be made by the instructor-in-charge in coordination with the safety officer, and should follow the Go/No Go sequence. The ignition officer and the safety officer shall both be present when actual ignition occurs, and a backup line must be utilized.
- The final controlled burn, including the expected remains and the possibility of a fire watch, should be planned for ahead of time.

Hot Terms

Acquired structure A building or structure acquired by the authority having jurisdiction from a property owner for the purpose of conducting live fire training evolutions

British thermal units (Btu) A unit of measurement indicating the amount of heat required to heat one pound of water 1° Fahrenheit (F) at sea level.

Construction Classification A set of predetermined factors that are used to help determine the minimum water supply based on the type of building construction of an acquired structure.

Fire flow rate The amount of water pumped per minute (gallons per minute or liters per minute) for a fire. There are several different formulas that are commonly used to calculate this.

Minimum water supply requirement The total amount of water, not flow, required for a given structure, based on its size, construction, and proximity to other structures or properties that could be damaged (exposures).

Occupancy Hazard Classification A set of predetermined factors that are used to help determine the minimum water supply based on the hazard levels of certain combustible materials.

References

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Live Fire Training Instructor *in Action*

You have been called to investigate an acquired structure training fire turned deadly. You have never been a part of an investigation before, but have been involved in countless successful live fire trainings. Being a third party removed from the event, your chief though it would be appropriate that you be chosen for this task. En route to the site, you begin running through questions in your mind about your last acquired structure fire:

1. Which of the following weather conditions is required to be monitored prior to and during the live fire evolution?
   - **A.** Lightning
   - **B.** Wind velocity
   - **C.** Wind direction
   - **D.** All of the above

2. Who is responsible for determining the rate and duration of water flow necessary for the evolution?
   - **A.** Fire chief
   - **B.** Instructor-in-charge
   - **C.** Training instructor
   - **D.** Safety officer

3. Which of the following is true regarding water supply for attack lines and backup lines?
   - **A.** They can be from the same source.
   - **B.** They must be from two separate sources.
   - **C.** They must both be from a municipal source.
   - **D.** None of the above.

4. Which of the following materials is acceptable to use as a fuel during the evolution?
   - **A.** Pressure-treated wood
   - **B.** Rubber to produce smoke
   - **C.** Plastics
   - **D.** Class A materials

5. To avoid uncontrolled flashover or backdraft:
   - **A.** use small amounts of flammable liquids to create and maintain fire size.
   - **B.** use combustible liquids in small controlled amounts.
   - **C.** the fuel load should be limited.
   - **D.** only hay or straw with pesticides should be used.

6. Each hose line shall be capable of delivering a minimum of how many gallons per minute?
   - **A.** 65 gpm
   - **B.** 75 gpm
   - **C.** 85 gpm
   - **D.** 95 gpm

7. The maximum number of fires permitted at one time within an acquired structure is:
   - **A.** one .
   - **B.** two .
   - **C.** three .
   - **D.** There are no limitations.

8. The participating student-to-instructor ratio shall not be greater than:
   - **A.** 1 to 1 .
   - **B.** 4 to 1 .
   - **C.** 5 to 1 .
   - **D.** 6 to 1 .