Using Class B Combustibles During Live Fire Training

Introduction

During their October 2004 meeting, the Certification Board of the North Carolina Fire and Rescue Commission requested a review of the exception taken to the NFPA 1403 Standard On Live Fire Training Evolutions, 2002 edition, in regards to Chapter 4, section 4-3 Fuel Materials, paragraph 4-3.6 stating “The use of flammable or combustible liquids, as defined in NFPA 30, Flammable and Combustible Liquids Code, shall not be permitted for use in live fire training evolutions in acquired structures.” The Commission at that time took an exception to this paragraph of this standard. The minutes published from the Commission meeting that adopted the 1986 standard stated: 1) The instructor must pass a Live Fire Qualification course, therefore being recognized by the Board as a Live Fire Training Specialist, and 2) use appropriate amounts of combustible liquids to start a fire.

This request for a review is born from two simple, but opposing opinions. One opinion would prohibit using class B combustible fuels in North Carolina live fire training, and the other would allow for using class B combustibles as a tool in the toolbox of the Live Fire Qualified instructor. Those that are against the use of class B combustibles site various theoretical reasons such as 1) its use provides an unrealistic training environment for interior structural firefighting practices, 2) its use overly soils turnout gear and reduces its effectiveness, 3) it is inherently unsafe, and 4) it increases the liability on the instructor and possibly the qualifying agency for taking an exception to a national consensus standard.

Those that believe the use of class B combustibles should be allowed state 1) it is a beneficial tool that should be available to a Live Fire Qualified instructor in a live fire training environment, 2) it increases the margin of safety by reducing the possibility of flashover, and limiting the degradation of the structure.

Overview

It should be made clear at the outset, that no definitive data exists that clearly defines the issue of whether or not class B combustibles should be used in live fire training. What is offered here is a position paper that involves available text on the subject, as well as opinions from individuals from both sides of the issue. Table 1 has been added to the end of this report in an attempt to characterize and define the importance of various live fire training incidents that have occurred since 1982.
A short historical perspective is in order. Following the Boulder Colorado live fire training accident in 1982 where two firefighters perished, the NFPA produced the Standard On Live Fire Training Evolutions in 1986. Chapter 2, paragraph 2-3.3 permitted small amounts of uncontaminated diesel fuel or kerosene for the ignition of fires. In the 1992, 1997 and 2002 editions, fuel materials were addressed in Chapter 2, paragraph 2-3.3 (1992, 1997) and Chapter 4, paragraph 4-3.6 (2002), and the use of flammable or combustible liquids was prohibited. The NFPA’s Technical Committee report for the 1992 edition on the change explained that “combustible liquids are not needed during these evolutions. Their use constitutes a safety hazard for the participants.” No data was provided to support this change, but it is widely accepted that the review of three major incidents of Boulder, Colorado (1982), Mesa, Arizona (1985), and Milford, Michigan (1987) galvanized the NFPA decision. Although all three investigations concluded that lack of planning and preparation were the determining factors that contributed to the incidents, both class A fuels with unknown burning characteristics and class B fuels were used.

In 1992 the North Carolina Fire and Rescue Commission faced the decision on whether or not to adopt the standard change prohibiting the use of class B combustibles. A survey was conducted with the fifty state training directors to find out how other state agencies addressed this issue (Bradley, 1992). 88% of those responding followed the guidelines of NFPA 1403. 50% took exception to the standard and allowed appropriate amounts of combustible fuels. 65% required a special qualification designation, or training for instructors who conduct live fire training. 3% of those that responded felt that training injuries from live fire training would warrant stronger requirements than NFPA 1403 contained at that time.

Also in 1992 Fire Chief magazine published an article titled “How To Reduce the Risks Of Live Fire Training In Acquired Structures” (Bradley, 1992) that referenced in detail the Live Fire Qualification course the North Carolina Fire and Rescue Commission authorized in 1988. The Fire and Rescue Division developed this instructor qualification course entitled Live Fire Training Specialist. This course has evolved through the years, but still promotes safety as its key ingredient. “The ongoing delivery of this course to interested instructors, and requiring the delivery agencies throughout the state to follow the Commission’s recommendations on live fire training when this course is taught, ensures the safest possible delivery for this type of training in North Carolina” (Bradley, 1992).

In November of 1997, the North Carolina Fire and Rescue Commission surveyed North Carolina Live Fire Qualified Instructors for opinions regarding use of Class B fuels in live fire training. 434 surveys were distributed and 164 were returned.
Survey results indicated that 153 instructors (93%) preferred using appropriate amounts of class B combustibles to ignite fires, while only 11 used class A only.

In 1998, the 1992 survey of the 50 state training directors was partially repeated (Pharr, 1998). 97% of those responding followed the guidelines of NFPA 1403. 36% allowed appropriate amounts of combustible fuels. 82% required a special qualification designation, or training for instructors who conduct live fire training. The question regarding stronger requirements in NFPA 1403 was not asked. Of note is an additional question in the revised survey. 43% of those responded said that ignition of class A fuels by placing an appropriate quantity of combustible fuel (less than one liter) onto the fuel for kindling and then igniting the liquid with a small flame was acceptable. This percentage runs contrary to the response in the same survey above regarding the use of appropriate amounts of combustible fuels, but it is probable that this more detailed question provided a more accurate answer. By 1998, almost all state training directors who responded to the survey followed the NFPA guidelines, but 43% of those took exception to the prohibition on the use of combustible fuels.

In May of 2003, FEMA published the report "Trends and Hazards in Firefighter Training." From 1987 through 2001, 7% of the reported injuries were the result of burns. No data was given on the specific causes of death during training. The report emphasized the hazards of live fire training and referenced several key incidents in the live fire training history. None of the incidents in this report documented the use of class B combustible fuels as the accelerant, or the defining cause of the incident or fatality.

Also in November of 2003, an Executive Leadership paper for the NFA EFO program was published by Phillip Welch titled "The Legal Liabilities Of Live Fire Training In North Carolina." Mr. Welch’s main concern was: “The issue of the legal liabilities associated with live fire training is a concern to this author because of the injury potential and risk involved in these evolutions. Although the Regional Emergency Services Training Center strictly observes every element of NFPA 1403, the issue of live fire training in North Carolina is further complicated by the fact that the NC Fire Commission and the NC Office of the State Fire Marshal have taken exception to the combustible fuel restriction of the standard.”

**Discussion**

Each of the four major criticisms for using class B combustible fuel in live fire training evolutions is addressed separately.
Using Class B combustibles provides an unrealistic training environment for interior structural firefighting practices.

This opinion differs from the instruction given during the Live Fire Qualification course. Class B material as a tool to start the training fire is applied to develop the ignition phase of the fire. It accelerates the fire and pushes it past the flashover stage into the steady state phase (Figure 1). The amount of realism is not dependant on the type of fuel, but on the evolution that the instructor is leading. The LF qualification course discusses this in detail. Part of the evaluation involves how the instructor handles such tactics as fire streams, hydraulic ventilation, and complete overhaul, but to be clear, this course does not teach fire behavior, or any of the FF I + II topics. The course qualifies instructors to conduct live fire training in a safe manner under live fire conditions. The course encourages instructors to train their personnel using the live fire suppression tools for the job performance requirements of the AHJ.

Another survey conducted by Pharr, 1998, asked instructors their opinions for the best training methods using either class A or class B materials. A majority of those surveyed felt that using class B materials provided a better challenge in suppressing a fire, overhauling practices, and using an SCBA. Overall, when asked which structure offered a better training opportunity to increase ones skill as a firefighter, the majority responded that the structure with the use of class B fuel afforded the best training opportunity.

An interesting note that should be brought out is the NFPA 1403 Appendix A.5.2.4. It reads: "Some training center burn buildings might utilize propane-fueled fires in lieu of Class A fueled fires and still create a realistic fire training experience." According to NFPA 1403 this class B fuel used in a burn building produces realistic training fires.
Using Class B combustibles overly soils turnout gear and reduces its effectiveness.

Diesel fuel produces large amounts of soot that adheres to turnout gear. So does paint on walls and ceilings as well as varnish found in acquired structures. The Live Fire Qualification course stresses keeping gear clean to maintain its integrity. Proper laundering and decontamination of each piece of turnout gear after all fires is essential and encouraged.

Class B combustibles are inherently unsafe.

The statement that using class B materials is inherently unsafe is the hardest opinion to quantify. There is little evidence from the 7% of burn injuries from 1987 through 2001 (FEMA, 2003) to establish class B materials as the culprit. In fact, the three injury investigation reports that OSFM has conducted or been involved in since 2001 concerning live fire training in North Carolina have been the result of instructor negligence and not in the use of class B fuels. Like the Lairdsville, N.Y. and Poinciana, Fla. fatalities that involved only class A fuels, one incident investigated in North Carolina involved using a foam cushion couch that is a class A material with unknown burning characteristics (Refer to Table 1).

One incident, not cited in the FEMA report, but with significance to the class B fuel question is the Greenwood, Delaware fatality in 2000. A flashover occurred in an attic training fire when a firefighter set several fires in different locations using different class A materials with unknown burning characteristics. He then sprayed diesel fuel with a pressurized extinguisher into the superheated atmosphere. The final report cited the use of diesel fuel as one of the causes for the fatality. The North Carolina Live Fire Qualification course does not allow the use of atomized fuel in pressurized extinguishers.

Using appropriate amounts of class B fuel to ignite the training fire has two beneficial characteristics that enhance safety. First, it reduces the amount of degradation to the prop, which is the structure, and reduces the chances for dangerous collapse. Degradation is reduced by reducing the amount of time that the structure is being exposed to the fire while the fire builds to the desired point of bringing in the nozzle crew. The total time that the prop can be used for training is lengthened. Pharr, 1998, reports that in his communications with instructors, fewer evolutions were conducted when using class A only to achieve the simulation of a one room of content fire than when class B fuels were used to start the fires due to the degradation of the structure. Also, the FEMA report, 2003, specifically addresses building collapse as a major cause of injuries and fatalities that must be closely monitored during live fire training exercises.
Starting the room of involvement with class B fuel moves the fire quickly past the
growth stage and flashover stage into the steady state phase of the fire. Contrary
to Pharr’s 1998 interpretation of the theoretical heat release data comparing
class A only to class B fuel as a fire starter, the calculations are interpreted to
courage the use of class B combustibles. Refer to figure 1 of this paper. Class
B materials used during the ignition phase, shortens the growth phase and
actually pushes the fire beyond the flashover stage into the steady state phase.
Smoke, heat and rollover are produced to provide the indications for flashover
that the instructor can use to demonstrate the inherent dangers of potential
flashover, but the flashpoint of common wall and ceiling coverings of the acquired
structure have been surpassed before the fire attack crew enters the building,
and the flashover dangers are minimized.

Pharr, 1998, reports some reservations about fire situations where an instructor
was unsure of when flashover would occur during a class A fire only burn. At one
point during a first Class A only burn, the instructor noted impending flashover,
withdrew his crew to a safe location, applied water to the threatening situation,
then moved in to extinguish the fire. The instructor reported this was a valuable
training lesson to all participants in that they observed first-hand indicators of
flashover. The crew during this class A only incident appears to have started its
attack during the growth stage of the fire that leads up to the flashover stage.
This is indeed a dangerous and unnecessary place to be on the fire development
path.

As an interesting point, NFPA 1403 6.3.6* states: Exception: Limited quantities of
combustible liquid with a flash point above 100°F shall be permitted to be used in
a training center burn building that has been specifically engineered to
accommodate this fuel. Class B fuels are permitted in a burn building, but not an
acquired structure. Why? It is unclear from the NFPA document what “specifically
engineered to accommodate this fuel” means to the training environment and
personnel.

It is also interesting to note that burn injuries also occur in burn buildings
specifically engineered for class B use. Reference the December 2004 NIOSH
Report entitled “Live-fire Exercise In Mobile Flashover Training Simulator Injures
Five Career Fire Fighters – Maine.”

Using class B combustibles increases the liability on the instructor and possibly
the qualifying agency for taking an exception to a national consensus standard.

Liability during live fire training is a concern, but what is pointed out during the
Live Fire Qualification course is this: if someone gets hurt from a burn injury, the
instructor or instructors and the delivery agency can be liable. If a mistake has
been made, regardless of the types of fuel used, someone can be liable. The fact that a class B fuel is used does not increase the liability, nor does using only class A decrease the liability; if someone gets hurt, someone can be liable. There is no evidence that having class B fuel on the fire ground as a tool to start fires increases the overall instructor or delivery agency liability.

This position paper would also like to point out that the Fire and Rescue Commission is the regulating body for the fire and rescue standards in the state of North Carolina. Its standards on live fire training are stricter than the national consensus standard of NFPA by requiring a Live Fire Qualification Specialty for instructors conducting live fire training. It is suggested that there is increased liability to those entities that do not follow the Commission’s standards and employ instructors that are not Live Fire qualified.

Conclusion

Realism of the training scenario is not decided by the class of material being used to ignite the fire, but is decided by the instructor and type of intended instruction.

Liability during an inherently dangerous training exercise is not an issue until there is an injury or fatality. If something happens, the issue becomes who or what caused the incident. If using class B fuel directly caused the accident, the instructor is liable for misusing class B material regardless of the consensus standard of NFPA 1403. If the instructor used class B fuels, but the cause of the accident was based on some other failure such as inadequate firefighter training, then using class B materials would not be an issue.

The North Carolina Fire and Rescue Commission is the regulatory body for the fire and rescue community. It has the authority to set the standards for North Carolina.

The Live Fire Qualification course emphasizes training Live Fire Qualified instructors to properly use all the tools available in the instructor’s toolbox. Class B fuels may or may not be the tool of choice for a Live Fire Qualified Instructor, but this tool should be available as a resource when potentially needed.

It is better to teach and emphasize the proper use of this tool than to deny its use from the Live Fire Qualified Instructor. Banning class B fuel might even encourage fire departments to ignore delivery agencies and Live Fire Qualified Instructors when conducting live fire training. The Commission should encourage the use of Live Fire Qualified Instructors on all Live Fire Training.
References

Fire Fighter Fatality Investigation and Prevention Program – Fire Fighter Fatality Investigation Reports, WWW.cdc.gov/niosh/firehome.html

Front Line Video: Safety First, Alabama Rural Community Fire Protection Institute.


Live-fire Exercise In Mobile Flashover Training Simulator Injures Five Career Fire Fighters – Maine, December 2004, NIOSH.


National Standards Versus Local Practice: A Case Study, Bradley, T.M., 1992, NFA EFO.

The legal Liabilities of Live Fire Training In North Carolina, Welch, P.B., 2003, NFA EFO.

<table>
<thead>
<tr>
<th>Incident</th>
<th>Type</th>
<th>Type Of Training</th>
<th>Class A</th>
<th>Class A w/ Unknown Burning Characteristics</th>
<th>Class B Combustibles</th>
<th>Class B Flammables</th>
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<td>Boulder, Colorado</td>
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Table 1

*Front Line Video: Safety First.
Trends and Hazards in Firefighter Training - Special Report.
NIOSH Report, Case# FACEF2001-38, 2001
NIOSH Report, Case# FACEF2002-34, 2002


