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NFPA 1402
Building Fire Service Training Centers
1985

National Fire Protection Association Batterymarch Park, Quincy, MA 02269

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The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

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NFPA 1402

Guide to

Building Fire Service Training Centers

1985 Edition

This edition of NFPA 1402, *Guide to Building Fire Service Training Centers*, was prepared by the Technical Committee on Fire Service Training and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 13-17, 1985 in Chicago, Illinois. It was issued by the Standards Council on June 6, 1985, with an effective date of June 26, 1985, and supersedes all previous editions.

The 1985 edition of this document has been approved by the American National Standards Institute.

Origin and Development of NFPA 1402

In 1963 a subcommittee of the Fire Service Training Committee developed a document titled, "How to Build Firemen's Training Centers." This informative report was published and circulated as a guide and served to improve the scope and efficiency of fire fighter training.

The developments in training in the past few years indicate that more facilities will be needed to accommodate the hundreds of thousands of paid and volunteer fire fighters throughout North America. This report describes some of the modern training centers now available for fire fighters seeking instruction in up-to-date techniques of fire extinguishment and fire loss control.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

NOTE: Membership on a Committee shall not in and of itself constitute an endorsement of the Association or any document developed by the Committee on which the member serves.

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NFPA 1402

Guide to

Building Fire Service Training Centers

1985 Edition

Chapter 1 Introduction

1-1 Scope.

1-1.1 The intent of this guide is to address the design and construction of training facilities for fire service personnel. An attempt has been made to cover the aspects which must be considered when planning a facility. It should be understood that it is impractical to list every single item which may be included in a training center or every type of specialty training facility which could be constructed. Therefore, the components of a training center necessary to accomplish general fire fighter training effectively, efficiently and safely are presented herein.

1-2 Purpose.

1-2.1 This guide is for the planning of fire fighting training facilities. Whether a particular situation requires inclusion of all the items listed or not, they are here for the stimulation of thought. This guide is intended as a shopping list to assist in the choosing of those elements which will be of the greatest benefit(s) to the planners.

1-3 General.

1-3.1 The construction of a fire fighter training facility, regardless of its size, will involve planning, design and the expenditure of funds. In order to derive the maximum benefits from the resources available, a comprehensive assessment of current and future needs must be made. This needs assessment must consider: current and future training needs; facilities currently available; organizations or departments utilizing the facility; and viable alternatives to new construction.

The resources available are a major constraint to facility development and construction. These resources include money, land, governmental support and private support. Questions involving the items noted above (and many others) must be answered during the planning of a facility.

This guide is intended to assist in this planning process.

Chapter 2 Cost-Effective Analysis

2-1 General.

2-1.1 Is a fire service training facility necessary in your community? If the answer is yes, then the initial step is to develop a statement on the broad purpose of the facility. For example:

"Everchanging technologies in fire suppression and fire prevention require that today's fire fighter be knowledgeable and well trained. A proper environment for obtaining this knowledge and training is equally as important. This facility will provide the physical requirements of a modern fire department training center and will enhance the community's well-being through better fire protection and fire prevention."

2-2 Alternative Facilities. If your fire department is going to request a training facility, be prepared to justify its existence. Explore the use of existing facilities at the state or regional level. If you are located in an industrial area, consider the fire training facilities of the local plants. You may be able to use their facilities or they may be willing to contribute to some of the cost of building a new facility. If a new facility is decided upon, here are some factors to be considered:

2-3 Cost Considerations. Who will assume the cost? Both initial and on-going costs need to be identified such as site acquisition, legal and architectural fees, staffing, building costs, apparatus and equipment, maintenance, utilities (water, electricity, gas) and roadway systems.

2-4 Cost-Effective Analysis. A cost-effective analysis should be conducted to enable a community to determine if the investment is cost-effective and if it is feasible to contribute to long-range financial support. This analysis should include those departments and agencies which will use the facility. As an example, local police share a need for driver training, physical fitness and classroom space. Combining the training facility with an in-service fire station can satisfy two needs and reduce the total impact of separate facilities.

2-5 Advisory Groups. If the community accepts the purpose of the facility, criteria then need to be established to judge how the purpose is being fulfilled. If a commission or advisory group has not been organized, one may be beneficial to interface between governing bodies and the fire department. Such a group can weigh the importance of the following potential benefits:

- Reduced injuries and deaths of civilians and fire fighters; reduced number of fires and property damage;
- Increased efficiency and morale of the fire fighting force; and
- Improved training capability and improved public image of fire department.

Chapter 3 Components and Considerations

3-1 General.

3-1.1 This chapter lists general components that could be placed in a training facility. There are other components that may be unique to a particular area of industry which are not included. For the purpose of this guide, the buildings are discussed separately; however, combinations may be necessary or advantageous. As long as the goal of an individual component is not compromised, each component can be placed in any location that is conducive to effective training and safety. The installa-

tion of all components is not necessary for an efficient training facility. The following list of components should be considered:

3-1.2 Administration and Support Facilities:
- Offices
- Conference areas
- Library
- Photo laboratory/dark room
- Printing/copying area
- Graphics/audiovisual aid preparation area
- Arson laboratory
- Student housing, dormitories
- Food service facilities/kitchen, cafeteria
- Restroom and locker facilities
- Apparatus maintenance and repair center
- Equipment and supply facility
- Storage space for various materials.

3-1.3 Indoor Instructional Facilities:
- Classrooms
- Auditorium
- Gymnasium
- Special training laboratories:
  - Task simulation
  - Automatic sprinklers
  - Pumps
  - EMS and rescue
- Storage space for equipment and props.

3-1.4 Outside Facilities:
- Drill tower
- Drafting pit
- Burn building
- Driving course
- Flammable liquids and gases/fuel distribution area
- Hazardous materials area
- Helicopter landing site
- Smoke building
- Storage space for equipment and props.

3-1.5 Site/Exterior Facilities:
- Water distribution, sewer and other utilities
- Parking facilities
- Site maintenance equipment and facilities.

3-2 Planning Considerations. Because a training facility is a specialized facility, there are a number of specific features to be considered. Also, since a fire department will probably only build one such facility to serve for some 40 or 50 years, it is desirable to call on the experience gained by others. The remaining chapters provide some specific areas of guidance. A few broad general comments follow:

- Avoid occupancy problems in the locale — check the area master plan
- Investigate the possible joint use with other agencies
- Explore available grant funds
- Develop an environmental impact statement
- Visit existing facilities for ideas and experience; new facilities may show state-of-the-art features, while older facilities may identify operational/maintenance problems to be avoided
- Consider weather-related problems and the effects of seasonal use
- Determine which part of the facility, if any, will have night use
- Provide ample space between buildings/outdoor facilities to enable simultaneous use
- Provide ample, secured storage space for each segment of the facility
- Select site landscaping which complements the training activities with minimum upkeep
- Choose interior/exterior finishes which require a minimum of maintenance
- Locate heating and air conditioning equipment where regular maintenance can be easily performed, but avoid the installation of individual units in classroom areas
- Provide separate locker and restroom facilities for male and female occupants, and separate facilities for staff and students
- Identify space needed for guests and visitors, staff, and future users
- Specify slip-resistant surfaces for all stairs and well-traveled paths
- Specify automatic sprinklers/smoke detectors for all appropriate areas
- Provide facilities for storage of fuel used in training
- Provide facilities for refueling apparatus
- Provide communications between structures and training areas
- Provide storage for apparatus, especially during cold weather
- Provide drinking water facilities at all drill areas including those out-of-doors.

3-3 Usage Guidelines. Rules should be developed regarding the use of the facility. The various components of the facility should be in use as much as possible. The needs of the prospective users will be fulfilled by proper scheduling. Insurance coverage of users must be verified before any use is authorized.

Chapter 4 Consideration in Locating the Facility

4-1 General.

4-1.1 Some aspects to consider in determining the placement of the training facility in the community are:

site, water supply, environment, security, support services and access to utilities.

4-2 Site Considerations.

4-2.1 What land is available? Does the municipality own land that could be considered for this purpose? Are there abandoned properties available? The cost of the land has to be within the parameter of the community's budget. A progression of spending might allow for the purchase of the necessary land one year and the construction of certain buildings in the future. This sequential plan would enable the community to realize their objective over an extended span of time rather than placing pressure on present resources for immediate large expenditures. On the other hand, utilizing a bond issue to build at this year's rate and pay off with future dollars may be more favorable. Financial consultation would be desirable.

4-2.2 Proper drainage is a major consideration because of the use of large amounts of water for certain exercises. Also, effort should be made to ensure that drainage will be sufficient for variable weather conditions as well as future expansion. There always is a possibility of a ledge formation or a high water table posing hidden problems; therefore, a geological expert should be consulted during the planning stages.

4-2.3 The slope of the land may be advantageous for drainage but an excessive slope may be a negative safety factor for manpower and apparatus movement especially when the surface is wet. Digging out a slope would be expensive; in addition, a cliff situation may be created. Future expansion may not be possible.

4-2.4 The area masterplan, if one is in existence, needs to be taken into consideration. The site of the training facility should be located away from the center of community life to minimize negative impact on adjacent land use. If the site has many positive factors and a plan variance is necessary, gather all the facts and make a professional presentation to the community's planning board. If possible, use the area masterplan to the fire department's advantage. The voting public should be made to understand the advantages of the training facility and every effort should be made to have them as allies in this endeavor.

4-2.5 The title to the property should be clear. Further expansion is often a possibility so the surrounding land should be surveyed. A land priority for fire department use would be beneficial to obtain. This would require the municipality to check with the fire department before allowing other usage. If possible, have the site marked prominently on land maps with a non-residential area around it. A lawyer's guidance would be beneficial in these endeavors.

4-2.6 Traffic patterns should be studied and the least detrimental route to the training facility should be chosen. Heavy, noise-producing apparatus should avoid residential areas. Travel time to the facility for the users must be taken into consideration.

4-2.7 The size of the site should be ample for planned buildings, parking, and future expansion. Allow adequate separation between buildings for safety, vehicular movement, and instructional purposes. It is better to conserve on structures than to overcrowd limited land.

4-2.8 Site pavement should be such that the facility can be used in all kinds of weather. Any pavement will deteriorate, especially when hydrocarbons or hot exhausts impinge on them. Concrete (cement) pavement seems to withstand training facility usage with minimum maintenance.

Landscaping and site layout should take into consideration local climatic conditions. Consideration should be given to rain, snow, wind, heat and other adverse elements that may affect facility operations.

4-3 Water Supply.

4-3.1 The maximum water supply required should be estimated so that an adequate system can be installed to deliver the necessary volume for training activities and domestic water needs. A loop or grid system with properly placed valves would help to ensure an adequate water delivery. If possible, dead-end mains should be avoided; if not, compensators (surge chambers) should be considered. Valves should be placed to segregate sections of the water system to allow for repairs without complete shutdown.

4-3.2 Type of hydrant(s) installed at the training center should be representative of the types found in the community. Where more than one community uses the training center and the hose threads are not uniform, a variety of fittings with appropriate threads will be needed.

4-3.3 Many fire departments' only source of water is drafting. Even where there is a hydrant system, drafting is always a good additional source. During times of water emergency, drafting may be necessary. Lakes or ponds, flowing streams, man-made containers, and dry hydrants are potential drafting sources.

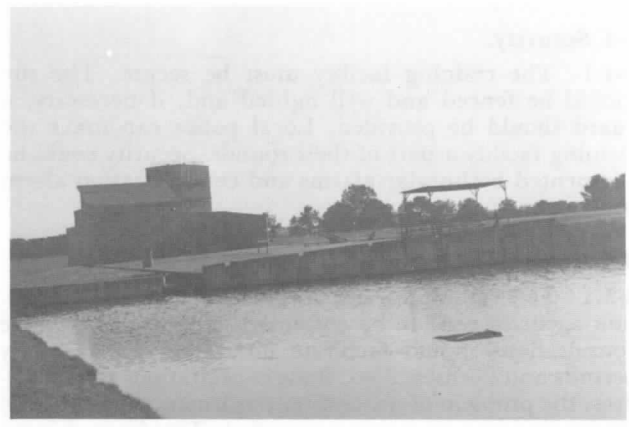

Figure 4-3.3 Pump testing area. Pump test can vary drafting height from 3 to 8 ft (10 cm to 240 cm). Note splash wall, pump test stand and protective cover area for students. Mississippi Fire Academy.

4-3.4 On-site water supply needs must be determined and storage containers constructed and/or installed.

Either elevated, surface, or underground storage may be used. Pumps could also be used to move the water at the desired pressure.

4-3.5 For durability, the water main should be constructed with bolted flanges or steel-rodded joints. If severe turns have to be engineered into piping, consideration has to be given to thrust blocks. Both of these features will help overcome the effect of water hammer. To keep a steady pressure in the water main, a compensator (surge chamber) should be installed.

Figure 4-3.5(a) Bolted and steel-rodded joints under compensator. New York Fire Department Fire Academy, New York, New York.

4-3.6 Tank trucks or long relays could be used to provide some water for training. This will increase the number of vehicles and personnel needed to accomplish basic evolutions; it will further increase the vehicular accident potential and maintenance cost.

4-4 Security.

4-4.1 The training facility must be secure. The site should be fenced and well lighted and, if necessary, a guard should be provided. Local police can make the training facility a part of their rounds. Security could be augmented by burglar alarms and central station alarm connections.

4-5 Environment.

4-5.1 Federal, state, and local environmental protection agencies need to be consulted. The results of these consultations should facilitate obtaining the necessary permits and licenses. Also, these consultations should address the problem of wastewater (treatment and disposal) and pollution (air, water and noise). The facts gleaned from these agency contacts may be of use when the architect is consulted.

4-5.2 Prevailing winds can be used to direct smoke away from neighbors. Shifting winds will have to be taken into consideration especially during training involving vapor-producing material. Residue from extinguishing agents and products of combustion have been found a considerable distance from the training site. A wind sock may be used advantageously to alert the training staff as to the wind movement. The growth potential of the facil-

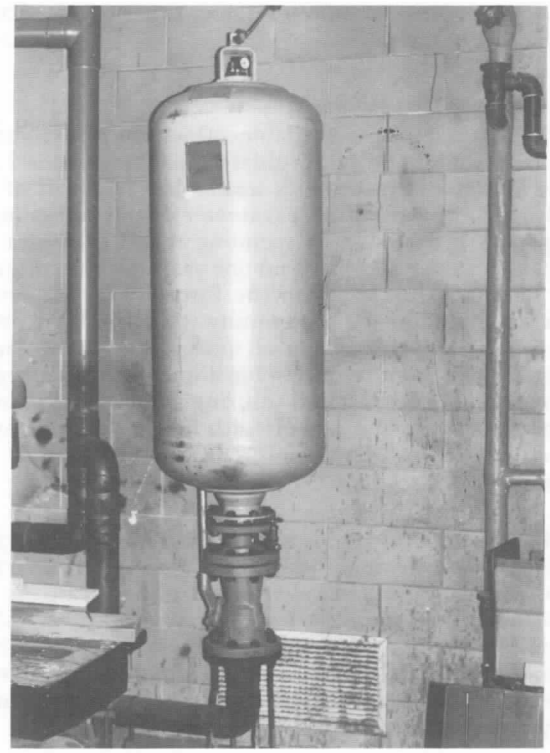

Figure 4-3.5(b) Compensator.

A. Charging valve — 45 psi
B. Gauge
C. Nitrogen in rubber bladder
D. 80 to 250 gal (304 L to 950 L) of water
E. Drain
F. Shutoff valve
G. Water main

Figure 4-4.1 Security fence. Omaha Fire Academy, Omaha, Nebraska.

ity must be given careful consideration. Effects of surrounding development and zoning changes may impact upon the attainment of long-range training goals.

4-6 Utilities.

4-6.1 The use of pumps, air compressors, simulators, heat, ventilation, and air conditioning (HVAC) units will greatly increase the power requirements. An on-site stationary electrical generator may be a practical alternative. The largest portion of the electrical needs will be dictated by the number of buildings and their purposes.

4-6.2 Coincidental with electrical requirements is the possible need for natural gas feed and telephone connections. The distance from these services could be a determining factor in locating the facility.

4-7 Support Services.

4-7.1 If housing and food services are to be provided, space will have to be planned for such purposes. Food service may be provided by a private vendor. The transportation of staff and trainees, housekeeping and laundry service, vending machine location, janitorial service, and ground and facility maintenance may have to be considered.

Chapter 5 Design and Construction

5-1 General.

5-1.1 The objectives the fire department wishes to reach by building a fire service training center need to be written down. Priorities have to be set. After proper research of this building project, an architect has to be chosen.

5-2 Architects.

5-2.1 Architects who specialize in fire service training facilities are available. Check with the American Institute of Architects (AIA) for references. There are local AIA chapters in many cities. Visit some training facilities and ask about their architect.

5-2.2 Consider visiting training facilities that have been in operation for a period of five to ten years to learn of any inherent construction or operational deficiencies. Ask the training personnel at the facility if they are satisfied with the architect's work. How would the training personnel improve the facility?

5-2.3 Interview the architectural firm before making the final selection. The architect's responsibilities are the design of the facility, the production of working drawings, and usually the supervision of construction.

5-2.4 Positive steps must be taken to ensure that the architectural firm will abide by the fire department's wishes and provide for declared needs. Such measures would include: educating the architect as to the training mission and the department's fiscal constraints, and establishing schedules for schematic reviews.

5-2.5 Contractors build according to approved specifications and blueprints drawn by the architect. A client has little recourse except through change orders. These orders must be approved by the architect and could be very expensive. Therefore, changes after a contract is let should be avoided. Some change orders may be necessary to reduce cost overruns. The procedure for executing a change order must be spelled out in the original contract.

5-2.6 A pre-bid conference with the architect is necessary to establish the requirements. A fire department representative should be present. A request-for-bids notice normally will follow the pre-bid conference. It is desirable to review the work process at such junctures as: 25 percent, 50 percent, 75 percent, 90 percent and 100 percent of the project completion.

5-2.7 As-built drawings should be provided and retained after the project has been completed for use during repairs, alterations and future expansions.

5-3 Clerk of the Works — Owner's Project Manager.

5-3.1 A clerk of the works may be necessary according to the complexity of the project. The clerk must be able to read blueprints and interpret specifications. The clerk's job is to be on the project daily, checking progress, overseeing the work of the contractors and insuring compliance with specifications.

5-3.2 Such a person is usually compensated by the fire department or the jurisdiction. At times the architect may provide on-site inspectional services.

Chapter 6 Administration/Classroom Building

6-1 General.

6-1.1 This chapter addresses the many components which must be considered when a jurisdiction is planning an administration/classroom building.

Certain components are required only if the structure will be used for administrative purposes; others are particular only to a classroom building. However, if the purposes are to be combined then all of the following items need to be considered. Only those items needed for your particular situation should be included to produce a viable, functioning administration/classroom building.

6-2 Offices. Office space should be provided for the officer in charge, assistant administrator, instructors and clerical personnel. Further office space will be dictated by agencies housed at the facility. Properly designed open office space can add flexibility. Do not forget to include closet and storage space.

6-3 Conference Room. A conference room is desirable for staff meetings, press conferences and use by the commissioner or the chief of department. A built-in projection booth increases the versatility of the room.

Figure 6-1.1(a) Administration building. Dover County Fire Academy, Dover County, New Jersey.

Figure 6-1.1(b) Administration building. Toronto Fire Academy, Toronto, Canada.

Figure 6-1.1(c) Administration building — including: director's office; boardroom; clerical area; instructor offices; A/V storage area; four classrooms with capacity for fifty students in each room, one double classroom with capacity for two hundred students, making a total student capacity of four hundred; dining area; kitchen; and student lockers with restrooms. Mississippi Fire Academy.

6-4 Auditorium.

6-4.1 The auditorium can be used for classrooms, seminars, promotional ceremonies and community activities. Movable chairs would increase the utility of this component. A balcony would add to the seating capacity. Physical fitness classes could be held in the auditorium.

6-4.2 The floor and the wall coverings could be designed to withstand indoor basic training when inclement weather precludes outside activities. A public address system should be installed. Some of the features discussed in the classroom component should be installed in the auditorium. (*See Section 6-5.*)

6-5 Classrooms.

6-5.1 Classroom size will be dictated by the number of students and the type of training to be conducted. For example, hands-on training may require more space per student than a lecture.

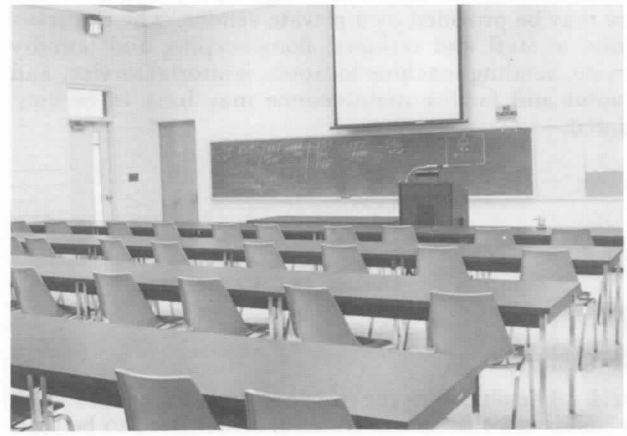

Figure 6-5.1 One of fifty-four student classrooms. Mississippi Fire Academy.

6-5.2 Movable soundproof walls can be utilized to vary classroom size. Adequate aisle space is necessary for proper classroom function. Heavy-duty flooring has to be installed to withstand the movement of fire fighters with soiled gear.

Figure 6-5.2 Large double classroom with capacity for two hundred or one hundred students per room with divider closed. Mississippi Fire Academy.

6-5.3 The instructor should be able to control room climate and audiovisual equipment. Good lighting is a must and the use of both individual controls and rheostats should be considered to vary the illumination. A podium light and separate chalkboard illumination can make a presentation in a darkened room more effective. Electrical outlets in the floor and the walls should be spaced to eliminate the use of extension cords. Before the sound system is installed, advise the installer to eliminate dead spaces in the room.

6-5.4 Classroom furniture has to be durable. Writing surfaces for use by the instructors and students should be provided. Folding tables, 18 in. (45 cm) wide, and stacking chairs permit greater flexibility in room utilization. Experience has shown that wider tables occupy space that can be better utilized.

6-5.5 To lessen classroom disturbance the following features must be considered: doors to the room should open and close quietly, sanitary and refreshment facilities should be close to the room, and ceiling height must permit the hanging of wall screens or the placement of portable screens for good viewing. The ceiling height should be a minimum of 10 ft (300 cm) as dictated by experience.

6-5.6 Air conditioning and heating units should not be installed in the classroom because of the noise factor.

6-6 Library.

6-6.1 The library is an essential part of the fire department training program. The library should contain job-related periodicals and technical books. The fire department's regulations, procedures, history, past and present orders, and local, state and national standards should be on the shelves.

6-6.2 An index system has to be maintained. Security of library contents has to be considered. The librarian should attempt to motivate retirees or people interested in the fire department to bequeath their fire department books to the library.

6-6.3 The services of a retired teacher may be secured on a voluntary basis. Most town libraries would be glad to assist the fire department in starting a library and providing advice.

6-6.4 If the library is large enough, individual carrels could be provided to allow the student to concentrate without interference. If there is a need, the library hours should include nights and weekends. The library should be located near the parking lot to decrease user travel and prevent classroom disturbance.

6-7 Kitchen and Cafeteria.

6-7.1 Kitchens could have the following appliances available for staff and trainees: refrigerators, stove, table and chairs, sink, vending machine, coffee maker, microwave oven, and dishwasher. If the facility is large enough, a cafeteria service line could be installed.

Figure 6-7.1 Dining area — seating capacity about eighty-five. Mississippi Fire Academy.

6-7.2 Fire protection for cooking equipment should be provided according to standards. It may be desirable to have a separate eating facility for the faculty. The dining area may be turned into a classroom.

6-8 Audiovisual Area.

6-8.1 To allow the instructor to take advantage of various media, the following equipment should be available: chalkboard (liquid chalk is highly desirable), felt board, hook and loop, and magnetic board. Cameras and associated equipment can be big assets in bringing realism to the classroom; the following could be used efficiently: portable video camera, recorder, and video editing machine. A TV monitor would be useful.

6-8.2 Projectors would fall into the following categories: Super 8 movie, 16-mm movie, 35-mm slide with a dissolve unit and an overhead projector with acetate roll. Cassette tape equipment, sound sync unit, portable wall or ceiling screen, or rear projectors are beneficial adjuncts.

6-8.3 To make a professional presentation an audio jack should be installed near any equipment use station.

6-8.4 To aid in the use of audiovisual equipment the following recommendations are made:

- Provide an extra electrical switch with a rheostat to control illumination
- Protect rearview screen with chalkboards
- Place projector area near hallway so equipment can be easily moved
- Provide adequate distance for front and rear projectors
- Avoid stepped-down ceiling if it will interfere with projection or viewing
- Provide heating, ventilation and air conditioning (HVAC) in the projection room to assure comfortable workers' environment and to avoid thermal shock to expensive electrical projector bulbs
- Provide projectors with permanent remote control wire
- Install electrical receptacles in the floor to eliminate the use of extension cords.

6-9 Darkroom.

6-9.1 The department's photographic needs may include a darkroom facility. Allow sufficient space for the necessary equipment, storage, and future expansion. The storage room could also be used as a projection booth; however, keep in mind the applicable firesafety regulations.

6-9.2 Taking the cost factor into account, it may be more economical to send material out for processing. Fewer personnel and less space will be needed. The disadvantage of this option is the time required to send material out and waiting to receive the finished product.

6-10 Printing Room.

6-10.1 The facility will require the reproduction of printed materials. Space for the following may be required: copier, mimeograph machine, offset duplicator, collator, binding machine, transparency maker, or electric stencil maker. Some of this equipment makes noise, so location of the printing room should be carefully considered.

6-10.2 Proper storage for flammables and an exhaust system should be considered during the design stages. Also, space to store supplies and printed materials is essential.

6-11 Graphic Unit.

6-11.1 A room for the preparation of graphics and other aids should be considered. Place this unit in a quiet area. In addition, space should be planned for instructor preparation of audiovisual programs (slide-tape, video, etc.)

6-12 Simulator Facility.

6-12.1 If simulation in training is desired, then space will have to be provided. Consideration may be given to the following types: flat board mock-ups, actual equipment, videotape, simple to complex computer arrangements, and rear screen projection.

6-13 Locker and Shower Facilities.

6-13.1 Locker and shower facilities are necessary. Separate areas must be provided for males and females. Included in this area would be a shower room(s), sinks with mirrors, and toilets. Remember to stress ventilation to reduce the water vapor accumulation from the showers.

6-13.2 Locker space will be required for: instructors/staff, long-term students (recruits, etc.), short-term students (one to three days), personnel utilizing the fitness room, and maintenance people. Separate areas are suggested for personnel lockers and turnout gear storage. The instructors' showers and lockers should be separate from the students'.

6-14 Cleanup/Drying Room.

6-14.1 A cleanup/drying room for turnout gear is a must if students leave their gear at the facility or if turnout gear is maintained at the facility. This area should provide space for the students and instructors to clean their gear with water from a hose or shower. This room should be accessible from the outside and from the locker room.

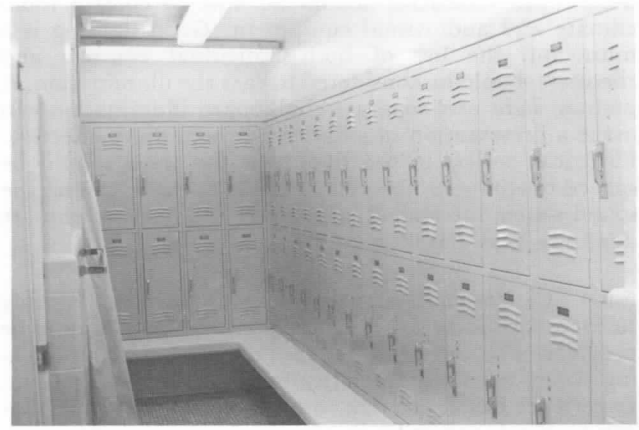

Figure 6-13.1 One of two student lockers with showers and restroom facilities. Mississippi Fire Academy.

6-15 Arson Lab.

6-15.1 It is recommended that the agency having responsibility for arson investigation be included in the planning stage of the facility. The arson investigation force might want office space; they might want room for sophisticated equipment or just a room to keep some teaching materials. Meetings between the arson group and the fire department planners will be necessary to determine their needs.

6-16 First Aid Room.

6-16.1 Safety should be the foremost consideration in facility design. Accidents and illnesses do occur; therefore, one or more properly designed first aid rooms should be provided. Space should be provided so that temporary care can be administered to victims suffering from burns, cuts, cardiac distress, smoke inhalation, heat exhaustion, and other injuries or illnesses.

6-16.2 A parking area for an ambulance should be provided during major training programs. Transportation for multiple victims must be considered. Communications with a local hospital may help provide resources for design as well as a personnel pool for staffing.

6-17 Building Maintenance.

6-17.1 The material used as a finish for the facility should be attractive and easy to maintain; durable material would cut down on replacement and refinishing costs. Custodial space will be required for deep sinks, mops and wringers, and cabinets for the storage of cleaning materials and other equipment.

6-17.2 Electrical outlets should be provided in hallways for use of buffers and vacuum cleaners.

6-18 Miscellaneous.

6-18.1 Public telephones should be provided.

Chapter 7 Drill Tower

7-1 General.

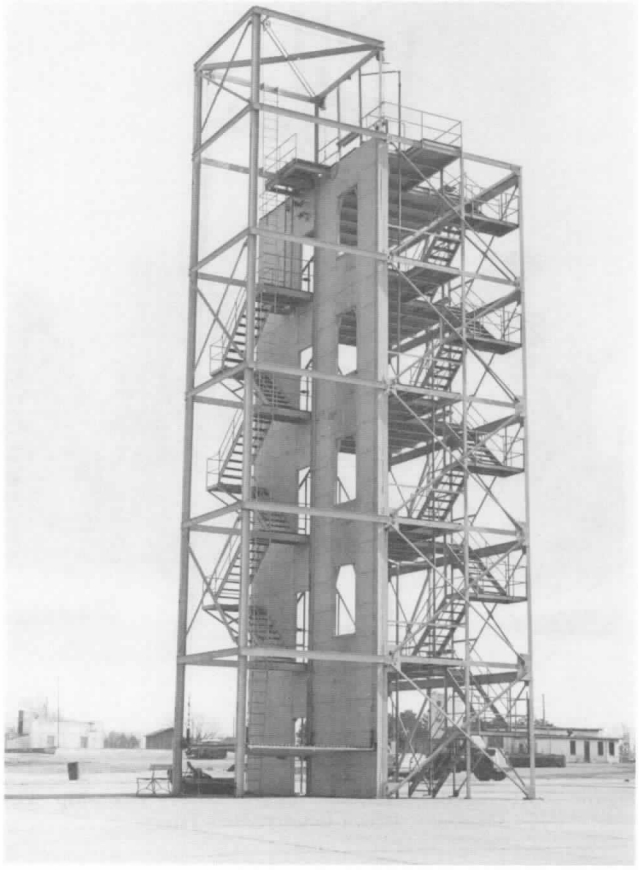

Figure 7-1(a) Drill tower. University of Kansas, Lawrence, Kansas.

7-1.1 The main purpose of the drill tower is to train fire fighters in the basic evolutions using pumper and ladder equipment. Using this tower will instill confidence in the trainees and further their ability to work at various heights in a skilled manner. Some areas have had requests from law enforcement agencies to use the tower to train in rappel or other skills.

7-1.2 While some training towers are designed for actual training fires, this is not a good practice. It is expensive to build such large structures with sufficient fire resistance to withstand intense heat. Soot and dirt resulting from such fires soon impair the tower for normal use. It is better to use the tower for training evolutions and conduct interior fires in another building.

7-2 Height.

7-2.1 The height of the tower should be typical of buildings found in the locale. However, consideration should be given to future community development. A six-story tower would seem optimum when evolutions involving the exterior of the tower, such as rappelling and pompiering, are performed. In these instances, adequate height must be provided between the ground and the first opening to accommodate safety net sag, while still maintaining a full story from the net to the first opening. In general, the height from the ground level to the first opening should be approximately 20 ft (600 cm).

Figure 7-1(b) Drill tower. Toronto Fire Academy, Toronto, Canada.

7-3 Construction.

7-3.1 The materials used in the construction of the tower may be wood frame, reinforced concrete, steel, or other durable material. Both interior and exterior walls of the drill tower should be structurally sound; this will provide for the safety of personnel in training and for withstanding the force of master streams.

7-4 Dimensions.

7-4.1 The tower should be at least 20 ft × 20 ft (400 sq ft of floor area) (600 cm × 600 cm [360,000 sq cm]). This will accommodate interior stairwell openings and allow room for fire companies to maneuver hose lines.

7-4.2 A square configuration may be easiest to construct [*see Figure 7-4.2(a)*] but a rectangular design will allow for an exterior enclosed stairway and a fire escape to provide two means of entrance or egress [*Figure 7-4.2(b)*]. The rectangular design will provide more interior floor space for hose stretching practice.

Figure 7-1.2(a) Drill tower. New York Fire Department Fire Academy, New York, New York.

Figure 7-1.2(b) Drill tower. Burlington County Fire Academy, Burlington County, New Jersey.

Figure 7-3.1 Ladder training tower. Dover Township Fire Academy, Ocean County, New Jersey.

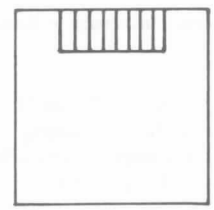

Figure 7-4.2(a) Square drill tower.

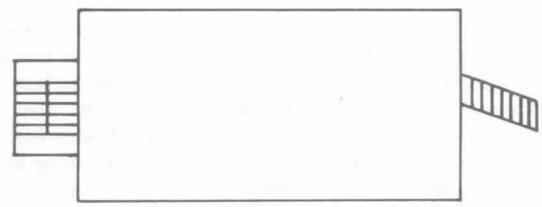

Figure 7-4.2(b) Rectangular drill tower.

7-5 Stairways.

7-5.1 Stairways in the drill tower may be provided either by interior or exterior means, or both. Stairways provide not only a means of access between floor levels, but also should simulate fireground conditions. A variety

of types, widths, and situations may be realistically represented. Stairways included in the tower should be located so as to maximize available interior floor area. All stairway treads in the tower should be slip resistant; open grate treads will prevent water accumulation.

7-6 Exterior Openings.

7-6.1 All doors and window openings should be fully framed and located so as to simulate situations existing in the field. If safety net operations are contemplated at the tower, all openings on that side of the structure should have heavy wooden sills installed to accommodate rope and pompier ladder evolutions.

7-6.2 If the tower cannot include various types of doors and windows, then a separate display mock-up including an example of each could be constructed. For those areas near ocean or river shipping facilities take into consideration doors/hatches found on ships.

7-7 Fire Escapes.

7-7.1 Various fire escape configurations can be placed on the building. Railings should be high enough to safeguard a fire fighter who may be operating a charged hose line on the fire escape. The bottom of the fire escape can terminate in a straight ladder or a counterbalanced ladder. The top of the fire escape could end at the top floor or go over the roof by means of a gooseneck ladder. Caged vertical ladders may also be desirable to have installed if they are representative of community construction.

7-8 Sprinkler and Standpipe Connections.

7-8.1 The drill tower should include provisions for standpipe connections at all floor levels of the facility. These connections will not only provide the opportunity to develop the proper routine of connecting to and providing a water supply for the system, but also may be utilized for simulated fire attack by fire forces operating in a high-rise building. Siamese connections should be installed and identified at ground level to accommodate auxiliary water supplies.

7-9 Roof Openings.

7-9.1 Roof openings should be provided for practice of ventilation procedures. Various size openings on both flat and sloped roof surfaces should be designed into the structure so various situations and types of roof conditions can be simulated. Normally, these practice sessions are best conducted at lower levels of the building because of the safety factor. In all cases, safety railings should be considered for roof operations.

7-10 Coping.

7-10.1 If not covered by the roof, the topmost section of the walls must have a coping. Heavy wood bolted into the structure is best for rope work and pompier ladder evolutions. Stone, concrete, or other material may break away in pieces or abrade equipment and personnel.

7-11 Nets.

7-11.1 Consideration should be given to the provision of a temporary or permanent safety net on at least one exterior side of the building, especially if rappelling or the use of pompier ladders is contemplated. A safe distance must be provided between the ground and the net to allow for movement upon impact.

Figure 7-9.1 Safety railing roof of smoke building. Burlington County Fire Academy, Burlington County, New Jersey.

- A temporary, removable net will allow full access to the tower
- Removal and proper storage will prolong the serviceability of the net
- Springs installed between the net and the perimeter frame will increase the life of the net by lessening direct impact on the net
- A ladder affixed to the tower for mounting the net should be considered
- For a permanent net a catwalk around the perimeter frame with a ladder to the ground can provide a standby area for instructor and trainees.

7-12 Drains.

7-12.1 Each floor of the building should be equipped with floor drains or scuppers. In areas subject to freezing temperatures, conventional floor drains may not be effective. Where scuppers are used, the water discharge should be directed to areas which will not interfere with activities below the openings. Regardless of the types of drains that are selected, their installation should ensure quick runoff of water.

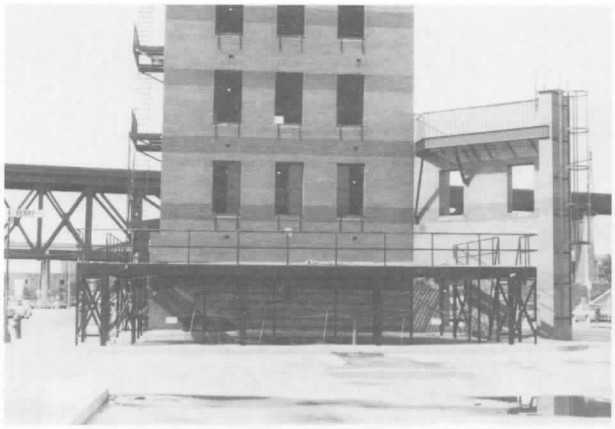

Figure 7-11.1(a) Frame of the net. New York Fire Department Fire Academy, New York, New York.

Figure 7-11.1(b) Springs anchored into the side of the drill tower. New York Fire Department Fire Academy, New York, New York.

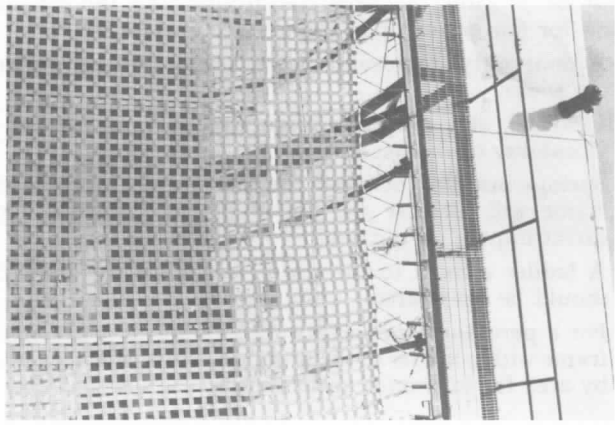

Figure 7-11.1(c) Texture of net and catwalk around net. New York Fire Department Fire Academy, New York, New York.

7-13 Special Training Features.

7-13.1 Special features can be included in the tower to accommodate local area needs. For example, a 36-in. (90-cm) diameter pipe may connect two floors for caisson and mine shaft rescue simulation. An elevator could be installed to be used in simulation of elevator emergencies and for the movement of personnel and equipment.

Figure 7-12.1 Scuppers at work on multiple dwelling. New York Fire Department Fire Academy, New York, New York.

Chapter 8 Burn Building

8-1 General.

Figure 8-1(a) Hot drill building. This building features two buildings in one — residential and commercial. The residential side is two stories with attic, six interior rooms, all masonry. Mississippi Fire Academy.

8-1.1 The purpose of the burn building is to safely train fire fighters in methods of interior fire suppression. Every room should have an exterior exit or a secondary means of egress. Burn areas below grade are not desirable and should be avoided. In order to provide simulated training for the suppression of basement or cellar fires, a raised open grid walkway can be constructed level with the second floor on the exterior of the building.

8-1.2 The building could be designed to take into consideration the following problems: fire spread, rescue, ventilation, and special problems.

Figure 8-1(b) Burn building consisting of a private dwelling section and a commercial section. Burlington County Fire Academy, Burlington County, New Jersey.

8-2 Fire Temperature.

8-2.1 Walls, floors, ceilings, and other permanent features must have strong resistance to heat generated by Class A materials. Class B materials should not be used for fuel because of their high heat production. High temperature training fires will cause accelerated deterioration of the structure and expose fire fighters in training to unnecessary risk.

Figure 8-1.1 Burn building with raised open grid walkway level with the second floor. New York Fire Department Fire Academy, New York, New York.

8-2.2 In planning a burn building, the designer, the architect, and the fire chief must consider the problems created by fire temperatures. If unprotected, concrete will spall and steel will distort when exposed to fire temperatures. Even in new burn buildings built with adequate protection, fires should be limited to short duration. To provide high temperature protection to the burn building the following materials may be utilized:

- Precast modules made from poured perlite or aluminate concrete form a wall which has high strength and resistance to spalling
- Gunning, the spraying of exposed surfaces with a cementitious concrete, provides a self-adhering joint-free surface whose usefulness can be extended by patching
- Refractory blocks set in refractory mortar
- Panels made from fire-resistive material can be attached to the structure.

8-2.3 As an alternative to the high cost of fire-resistant materials, a fire in a heavy gauge metal drum, with metal plates welded above to prevent flame impingement on the structure, can be utilized as a smoke and heat simulation method. If utilized, the drum should be raised above the floor and the floor protected with a steel plate.

8-3 Instrumentation.

8-3.1 The purpose of the instrumentation is to keep the fire within safe parameters, observe the effect of suppression agent application, and with sophisticated equipment observe and record the products of combustion. Thermocouples and analyzing equipment can be used to attain the first two objectives. Extremely large budgets have to be anticipated for involvement in the products of combustion analysis without a special grant. Staff, equipment, and time requirements generally make this choice beyond the fire department's capability. Department standards should be set before becoming involved with the purchase of instruments.

8-4 Built-in Safeguards.

8-4.1 The first step in the safeguarding of both staff and trainees is the proper design of the building. Emergency ventilation can be provided by manual control of the roof openings, doors, and exterior shuttered windows.

8-4.2 Open sprinklers are not reliable in a burn room because of repeated heat exposure. Other methods of applying water must be provided and coordinated with proper ventilation procedures.

8-5 Cutouts.

8-5.1 In order to perform rescue and ventilation evolutions, parts of the building should be designed which can be destroyed and replaced. These expendable sections (cutouts or chopouts) can be located in walls, ceilings, or roofs.

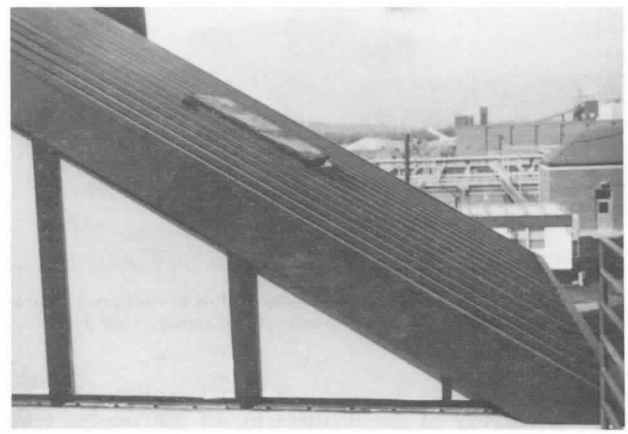

Figure 8-5.1 Pitched roof with chopout. Alexandria Fire Department, Alexandria, Virginia.

8-5.2 The cutout openings should have a safety device installed to prevent personnel or tools from falling through. Take into consideration that the cutouts can catch on fire, cost money to replace, and manpower will be needed to reconstruct them.

Chapter 9 Smoke Building

9-1 General.

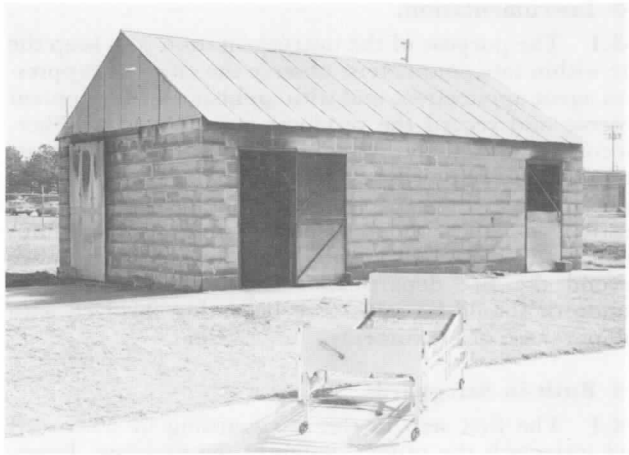

Figure 9-1 Smoke building. University of Kansas, Lawrence, Kansas.

9-1.1 The purpose of the structurally safe smoke building is to acquaint the trainees with the skills and abilities necessary for survival in an oxygen-deficient atmosphere by creating a controlled learning situation that is under constant supervision.

Figure 9-1.1 Smoke building with exhaust fan at roof level. Burlington County Fire Academy, Burlington County, New Jersey.

9-1.2 The building should be designed to allow for constant surveillance of the trainees by an instructor. This may be accomplished by accompanying the trainee, by observing the trainee through windows, or by using closed circuit television (CCTV). CCTV can only be used when the smoke concentration is light or nonexistent.

9-1.3 A maze can be built as an enhancement for mask training. It should be large enough to allow the trainees to crawl with their masks donned. This could be a simple 4 ft square (120 cm²) wooden tunnel.

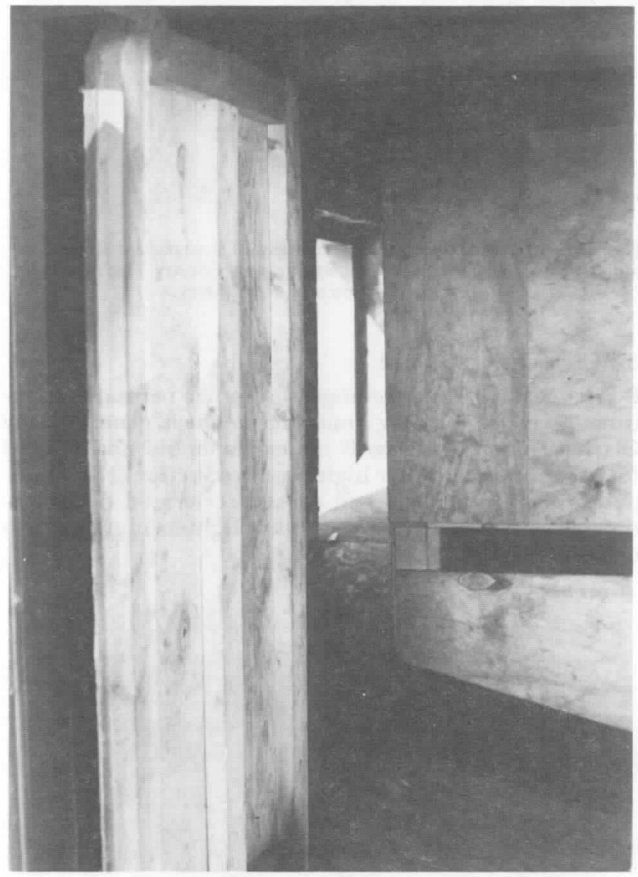

Figure 9-1.3 Maze-interior of smoke building. Burlington County Fire Academy, Burlington County, New Jersey.

9-2 Flexibility.

9-2.1 The facility should have the ability to change the interior configuration so that various situations can be created. The utilization of modules or segments which can be quickly changed provides for maximum benefit at a minimum cost.

9-3 Safety.

9-3.1 The smoke building should have entry points and escape hatches at frequent intervals in case of an emergency.

9-3.2 Any area of the maze that cannot be seen and reached by the instructor should have the walls or top hinged so that any section could be opened. This would make trainees accessible to the instructor continually.

9-3.3 Some smoke rooms have sensors built into the floor that indicate where the trainees are at all times.

9-3.4 Provisions must be made for quick ventilation of the building if needed. Consideration should be given to quickly stopping or redirecting the smoke being introduced into that section of the smoke building; this may be accomplished by the use of blowers or exhaust fans.

9-3.5 Communications capability between the instructor and trainees should be designed into the system. This will provide additional safeguards as well as the ability to transmit instructions to the trainees.

9-4 Smoke.

9-4.1 Smoke used in the training facility should be of a controlled composition with minimum toxicity. Specially designed mechanical equipment may be installed in the facility to produce training smoke. The use of military-type smoke grenades, rubber tires, diesel fuel, or other sources should be avoided. Hay, straw, cardboard boxes, or similar combustibles provide a much more typical fire and are considerably safer.

Figure 9-4.1 Smokemaking machine — very simple 55-gal (209-L) drum with hinged door half and smoke pipe to rooms on various floors.

Chapter 10 Combination Buildings

10-1 General.

Figure 10-1(a) Combination building. Omaha Fire Academy, Omaha, Nebraska.

Figure 10-1(b) Combination building — maximum use of minimum space with existing smoke stack for EPA considerations. Building provides for ventilation; smoke chamber; rappeling; laddering; live fire training; sprinkler laboratory; gas and electric cutoff; and forcible entry.

10-1.1 In many training facilities, either because of a lack of available space or funds, or both, individual structures for ladder evolutions, fires, or smoke training may not be built. In these instances, a combination building may be constructed embracing all of the desirable functions in one structure. Consideration should be given to any detrimental effects any one function will have on the facility, equipment or other functions.

10-1.2 Certain combinations of functions are, by their very nature, more compatible than others. Consideration might be given to combining all functions except actual fires; the fire function usually results in faster than normal deterioration of the facility. If adequate protection from water and smoke damage is provided, then classroom facilities may be combined with the drill tower and smoke function. Many other combinations are possible, depending on what functions are required or desired,

including functions performed by other divisions of the department. Most facility planners find that the limiting factors are available space and funding.

Figure 10-1.2(a) Fire apparatus building classroom. This building is approximately 100 ft (29.9 m) long with five 15-ft (450-cm) overhead doors, classroom, maintenance area and apparatus storage area. Mississippi Fire Academy.

Figure 10-1.2(b) Combination building classrooms, mask service unit, garage and kitchen. Burlington County Fire Academy, Burlington County, New Jersey.

Chapter 11 Outside Activities

11-1 General.

11-1.1 Ample outside space should be provided for a variety of activities including auto extraction, ventilation, forcible entry, and salvage. Specific layouts will be needed as permanent installations for training in the following areas:

11-2 Flammable Liquids and Flammable Gases.

11-2.1 This area should be located as remote from the main building as possible. Fencing and/or curbing should be provided as a safety factor.

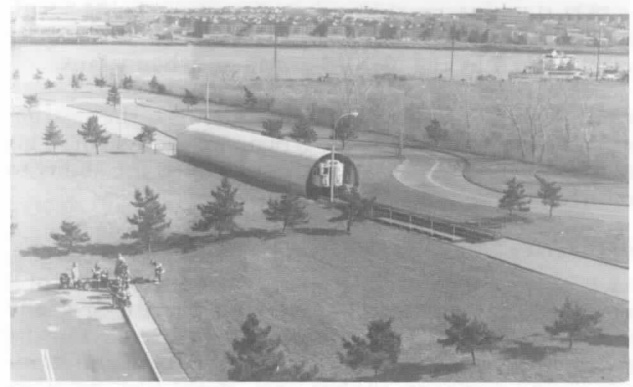

Figure 11-1 Transportation problem — train in tunnel. New York Fire Department Academy, New York, New York.

Figure 11-2 Flammable liquid burn area. Area includes cross pit, oval pit, square pit, electrical transformers, baffled pit, running spill area, drum pit, vertical tank, horizontal tank and railroad tank car. Mississippi Fire Academy.

11-2.2 Pits can be constructed in various sizes and shapes. Obstructions can be built into these pits to make extinguishment more difficult. Pit aprons should be made of concrete, crushed stone, or iron ore slag.

Figure 11-2.2 District of Columbia Fire Department flammable liquid pond. Note heavy stone surrounding pond.

11-2.3 Other props might include aboveground tanks, overhead flanges, "Christmas trees," and liquefied petroleum gas facilities. For this area, careful consideration must be given to water supply, fuel supply, fuel pumping capability, drainage, and environmental regulations. Close coordination with environmental protection agencies is essential to ensure that the area is designed to applicable standards.

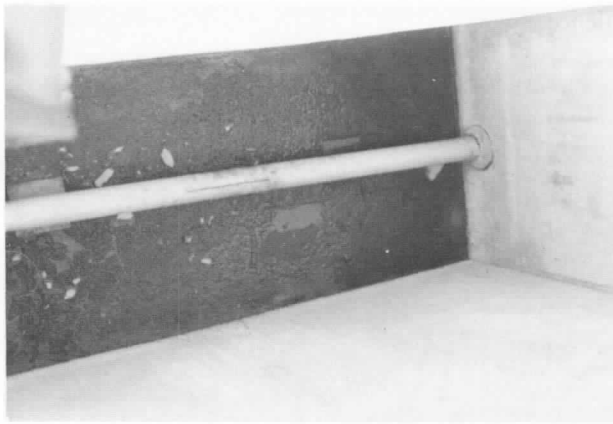

Figure 11-2.3(a) District of Columbia Fire Department, Washington, DC — natural gasline rupture in subsurface excavation.

Figure 11-2.3(b) Industrial tank rescue training aid. Fire Protection Training, Texas A. & M. University.

11-2.4 If flammable liquid or gas is fed to an area, the flow must be controlled by quick shutoff valves. In case of an emergency, an instantaneous shutdown will be necessary.

11-3 Electrical.

11-3.1 Electrical safety could be taught by constructing various electrical wiring systems between poles. Some electrical problems that might be addressed are downed wires, vaults, transformers, meters, and main disconnect. The local utility could be requested to participate in the planning phase of this section of the training facility.

Figure 11-2.3(c) Christmas tree mock-up. Note piping where flammable liquid under pressure is fired off. Metal shell increases fire concentration.

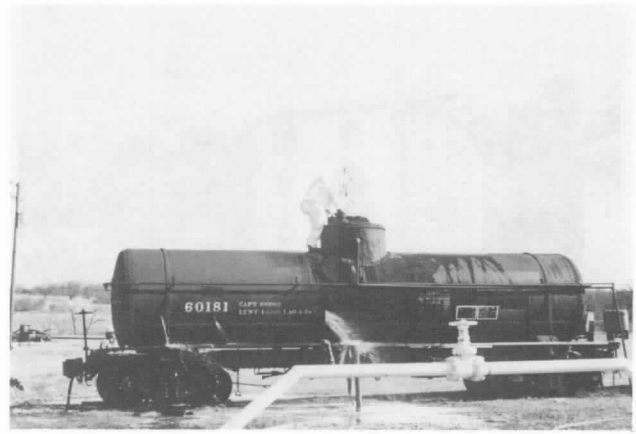

Figure 11-2.3(d) Hazardous material spill training aid. Fire Protection Training, Texas A. & M. University.

Figure 11-2.3(e) Flammable liquid cooled electric transformer mock-up. Note diking to contain runoff.

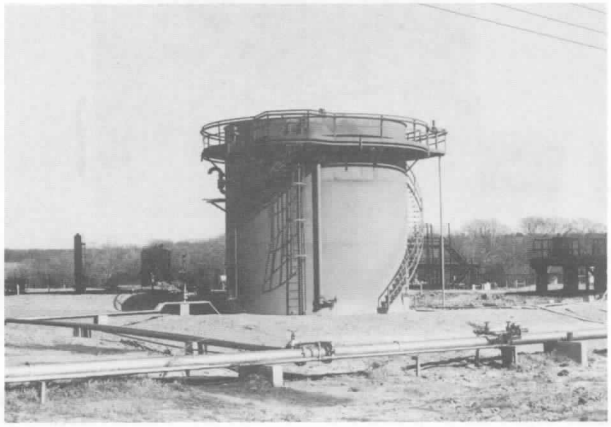

Figure 11-2.3(f) Vertical "floating roof" fuel storage tank fire training aid. Fire Protection Training, Texas A. & M. University.

Figure 11-3.1 Electrical safety when using ladders. Dover County Fire Academy, Dover County, New Jersey.

11-4 Drafting Pit.

11-4.1 A drafting pit is desirable to facilitate the training of pump operators and to test pumper apparatus. In general, a capacity of at least 5000 gal (19 000 L) of water is necessary, assuming water will be recycled to the pit. Where the pit also serves as the sole supply of water for training, much larger quantities will be needed.

11-4.2 Permanently installed wood chafing blocks are desirable to lessen wear on the hose; tie down rings are also beneficial. It is desirable to have a hinged cover on the pit. Ample access openings are needed and collection hoods can be arranged to direct pumper discharge back into the pit. Baffles are needed in the pit to minimize turbulence.

Figure 11-4.2 Collection hood. Omaha Fire Academy, Omaha, Nebraska.

11-4.3 Instrumentation should be placed in a protected location. It may be advantageous to locate the instrumentation in an area removed from the apparatus noise. In this case an intercom system may be needed between the instrumentation area and the pump operator. When portable instrumentation is used, provisions can be made for the units.

11-5 Apparatus Driver Training Course.

11-5.1 The design features of any driver training course should challenge the abilities of the student driver based on the customary or anticipated problems encountered in that particular jurisdiction, and by matching those challenges to practical situations. In addition, course components must reflect national professional qualification standards for driver training certification.

11-5.2 Limited resources, high property values, and availability of sufficient property adjacent to the proposed facility will impact on the design features of the driver training course. Resource pooling with other departments or agencies might be explored as a means to overcome these obstacles.

11-5.3 The specific design components must be agreed upon in advance and suitable time sharing agreements reached prior to any commitment of funds. Agreements between different parties should be resolved at the very minimum through an appropriate "letter of understanding" or preferably a formal contract.

11-5.4 Incorporating driver training space within the drill field area of the training facility is by far the most