Report of the Committee on

Helicopter Facilities

Committee Scope: This Committee shall have primary responsibility for documents on the fire protection criteria for the design and construction of elevated and ground level heliports, helistops, and helipads; fire protection requirements for heliports, helistops, and helipads; and requirements for rescue and fire-fighting operations at heliports, helistops, and helipads.

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. A key to classifications is found at the front of this book.

The Report of the Technical Committee on **Helicopter Facilities** is presented for adoption.

This Report was prepared by the **Technical Committee on Helicopter Facilities,** and proposes for adoption, a complete revision to NFPA 418, **Standard for Helicopters, 2001** edition. NFPA 418-2001 is published in Volume 8 of the 2004/2005 National Fire Codes and in separate pamphlet form.

This Report has been submitted to letter ballot of the **Technical Committee on Helicopter Facilities,** which consists of 11 voting members; of whom 9 voted affirmatively, and 2 ballots were not returned (Ambers, Petersen).

Mr. Smith voted affirmatively with this comment:
I have no objections to the passage of the proposed changes, however I offer these comments:
5.5 Means of Egress.
Comment: Upon further thought this now assumes that all landing pads are above the roof. I agree with the intent of the section but we should not rule out helipads that are the roof surface. Perhaps a better would be, “At least two means of egress from the rooftop landing pad edge and/or to the roof shall be provide and shall be remotely located from each other.” This also allows for direct evacuation from the landing pad without a stop on the roof.

Note: To assist in review and comment, a draft of NFPA 418 is available and downloadable from the NFPA website at www.nfpa.org. It is also in CD ROM and print versions available from NFPA upon request by calling Customer Service at 1-800-344-3555.

418-1 Log #CP2 **Final Action: Accept**
(Entire Document (MOS))

Submitter: Technical Committee on Helicopter Facilities
Recommendation: Restructure entire document to comply with the NFPA Manual of Style as follows:
1. Chapter 1 to contain administrative text only.
2. Chapter 2 to contain only referenced publications cited in the mandatory portions of the document.
3. Chapter 3 to contain only definitions.
4. All mandatory sections of the document must be evaluated for usability, adoptability, and enforceability language. Generate necessary committee proposals.
5. All units of measure in the document are converted to SI units with inch/pound units in parentheses.
6. Appendices restructured and renamed as "Annexes."
Substantiation: Editorial restructuring, to conform with the 2000 edition of the NFPA Manual of Style.
Committee Meeting Action: Accept

418-2 Log #CP3 **Final Action: Accept**
(Entire Document)

Submitter: Technical Committee on Helicopter Facilities
Recommendation: The Technical Committee on Helicopter Facilities proposes a complete revision to NFPA 418, Standard for Heliports, as shown at the end of this report. Additionally, proposals with affirmative actions were incorporated into this complete revision of the document.
Substantiation: The standard was revised to comply to the NFPA Manual of Style. Additionally proposals with affirmative actions were incorporated into this complete revision of the document.
Committee Meeting Action: Accept

418-3 Log #1 **Final Action: Reject**
(Title and 1.3 Helistop)

Submitter: Ken Bush, Chair General/WFCA/NFPA AD-Hoc Committee
Recommendation: Change the title to Standard for Heliports and Helistops .
Add a definition of Helistop to read: Helistop is the same as a heliport, except that no fueling, de-fueling, maintenance, repairs or storage of helicopters is permitted.
Substantiation: The proposed text merely provides clarification of code requirements by creating a defined term following accepted industry use.
Committee Meeting Action: Reject
Committee Statement: 1. The term is not used in the standard.
2. The proposed definition contains a requirement.
3. A helistop is a minimal form of heliport. Therefore the requirements for a heliport would apply to a helistop.

418-4 Log #CP1 **Final Action: Reject**
(1.3 Definitions (GOT))

Submitter: Technical Committee on Helicopter Facilities
Recommendation: Adopt the preferred definitions from the NFPA Glossary of Terms for the following terms:
Rooftop Landing Pad. (preferred) NFPA 5000, 2002 ed.
The entire load-bearing surface intended for the landing, takeoff, and parking of helicopters.
Rooftop Landing Pad. (secondary) NFPA 418, 2001 ed.
The entire load-bearing surface intended for the touchdown and lift off (TLOF) of helicopters.
Substantiation: Adoption of preferred definitions will assist the user by providing consistent meaning of defined terms throughout the National Fire Codes.
Committee Meeting Action: Reject
Committee Statement: Adding "Parking" would expand the area. The requirements in the standard are intended to protect the rooftop landing pad as defined.

418-5 Log #3 **Final Action: Accept in Principle**
(Chapter 3)

Submitter: James Everitt, Western Regional Fire Code Development Committee
Recommendation: Revise heading to read:
Chapter 3 General Requirements
Rooftop Landing Facilities
~~Additional Protection~~
Substantiation: Consistency with Chapter 2.
Committee Meeting Action: Accept in Principle
1. In the title of Chapter 3, delete "Additional Protection".
2. Add the following text and renumber existing paragraphs accordingly.
2.1 The requirements in this chapter shall apply to all land based facilities. (See Chapter 6 for Offshore Heliports).
3.1 The requirements in Chapters 2 and 3 shall apply to all rooftop landing facilities.
Committee Statement: Clarification.

418-6 Log #CP10 **Final Action: Accept**
(3.4 (New))

Submitter: Technical Committee on Helicopter Facilities
Recommendation: Revise 3.4 to read as follows:
3.4* Means of Egress. At least two approved means of egress from the rooftop landing pad edge to the roof shall be provided and shall be remotely located from each other to the extent practical.
Substantiation: Clarification.
Committee Meeting Action: Accept

418-7 Log #5 **Final Action: Reject**
(3.4.1)

Submitter: Robert Bourke, Northeastern Regional Fire Code Dev.
Recommendation: Revise to read:
3.4.1 For heliports occupied by 50 or more people, two approved means of egress from the roof shall be provided and shall be remotely located from each other to the extent practical, but shall not be located less than 30 ft (9.1 m) from each other. ~~For heliports occupied by fewer than 50 people, one approved means of egress from the roof shall be provided.~~
Substantiation: Section 3.4 Means of Egress states: At least two approved means of egress from the rooftop landing pad edge shall be provided and shall be remotely located from each other to the extent practical. Section 3.4.1 contradicts Section 3.4 by allowing only one means of egress when 49 or fewer persons occupy the heliport. The requirement for two means of egress is to provide a way out should there be a fire that cuts off the first means of egress. That margin of safety should not be diminished because there are only 49 people.
Also, Section 3.5 requires the helicopter rooftop landing pad to have at least two access points for fire-fighting purposes and the access through the landing pad egress is permitted. Therefore, there should not be a burden to require two means of egress for all heliports.
Committee Meeting Action: Reject
Committee Statement: The Committee reviewed NFPA 101, paragraph 7.12.2 and felt that it set the precedent for allowing one means of egress for a penthouse on a rooftop. The committee did not agree with the 50 ft travel distance for new construction in 7.12 as explained below. The committee then reviewed scenarios for possible fires on the landing pad. In each scenario, the hazard area would be the landing pad area and people would be leaving the pad from one of the two approved means of egress from the landing pad edge to the roof (required by NFPA 418, paragraph 3.4) and proceeding to the means of egress required by 3.4.1. The committee disagrees with the submitter that 3.4.1 contradicts 3.4. The committee believes that requiring 2 means of egress from the landing pad to the roof provides the minimum criteria to allow for self evacuation from the hazard area (the landing pad). Requiring all rooftop landing pads to have two means of egress would be over-restrictive and unnecessary for many installations. The standard does not prohibit additional exits from being provided where scenarios would support the need, but requiring this for all heliports might make some heliports less safe if the additional stairwell ends up too close to the landing pad.

418-8 Log #2 **Final Action: Accept in Principle**
(3.5.1 and 3.5.1.1 (New))

Submitter: James Everitt, Western Regional Fire Code Development Committee
Recommendation: Add new Sections 3.5.1 and 3.5.1.1 to read:
3.5.1 Access to the buildings interior shall be provided through each required exit stairway that extends onto the roof.
3.5.1.1 Where doors accessing the interior of the building are locked, an approved means shall be provided for entry of emergency responders.
Substantiation: One of the primary uses of rooftop heliports is to provide access to the interior of the building for firefighters.
Committee Meeting Action: Accept in Principle
Add the following text:
3.5.1* Where required by the authority having jurisdiction, access to the building's interior shall be provided through each required exit stairway that extends onto the roof.
A.3.5.1 Where doors accessing the interior of the building are locked, an approved means should be provided for entry of emergency responders.
Committee Statement: The proposed 3.5.1.1 should not be a minimum requirement for all heliports for security reasons, but should be a consideration and dependent on the emergency plan.

418-9 Log #6 **Final Action: Accept in Principle**
(3.6)

Submitter: Robert Bourke, Northeastern Regional Fire Code Dev.
Recommendation: Revise to read:
3.6 Fire Protection. A foam fire-extinguishing system shall be designed and installed to protect the rooftop landing pad.
Exception No. 1: A foam fire-extinguishing system shall not be required for heliports located on ~~parking garages~~ , unoccupied buildings or other similar unoccupied structures.
Substantiation: Parking garages are occupied structures and deserve protection like any other occupied structure.
Committee Meeting Action: Accept in Principle
Revise Section 3.6, Exception No. 1 to read as follows:
Exception No. 1: A foam fire extinguishing system shall not be required for heliports located on open parking structures or not normally occupied buildings.
Committee Statement: The committee felt that using "similar unoccupied structures" could lead to confusion as parking garages are considered to be occupied structures. The fire exposure hazard for an open parking garage is considered to be similar to a parking lot at grade level.
NFPA 88A, Paragraph 6.1.3 does not require a fire protection system for open parking structures.

418-10 Log #CP4 **Final Action: Accept**
(3.6)

Submitter: Technical Committee on Helicopter Facilities
Recommendation: Revise 3.6 to read as follows:
3.6 A foam fire extinguishing system with either a fixed discharge outlet(s) in accordance with 3.6.2 or a hose line(s) in accordance with 3.6.3 shall be designed and installed to protect the rooftop landing pad. [the exceptions remain]
Substantiation: Clarification.
Committee Meeting Action: Accept

418-11 Log #CP5 **Final Action: Accept**
(3.6.1)

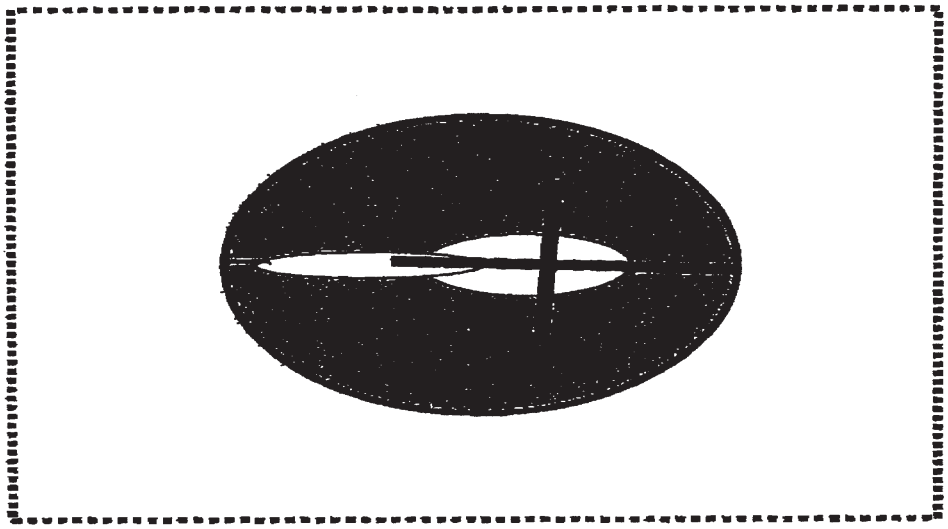
Submitter: Technical Committee on Helicopter Facilities
Recommendation: Change the title of Table 3.6.1 to read as follows:
Table 3.6.1 Foam Discharge Rates for Fixed Discharge Systems Only
Substantiation: Clarification.
Committee Meeting Action: Accept

418-12 Log #CP11 **Final Action: Accept**
(3.6.1)

Submitter: Technical Committee on Helicopter Facilities
Recommendation: Add the following:
3.6.1 Where trained personnel are not available, fixed fire protection outlet(s) shall be provided.
Substantiation: Hose line systems are only appropriate where trained personnel are available within a reasonable response time for effective fire knockdown, control and extinguishment.
Committee Meeting Action: Accept

418-13 Log #4 **Final Action: Reject**
(3.6.2)

Submitter: Bernard Valois, Transport Canada Civil Aviation
Recommendation: Revise as follows:
3.6.2
The area of application of foam discharge for fixed discharge outlet systems shall be the entire rooftop-landing pad. The duration shall be 5 minutes.
Insert new paragraph 3.6.2.1*
Where the rooftop landing pad area exceeds in length or width the overall length of the helicopter using the facility, and that a fixed discharge outlet system is supplemented by a foam hose line reaching all potential rooftop fire risk areas and, capable of flowing at the rates identified in table 3.6.3, the area of application of foam for the fixed discharge system shall be allowed to be adjusted using the following formula:
((Helicopter maximum overall length / 2) X (Helicopter maximum overall length / 2)) X 3.1416 = Corrected landing pad area of application of foam discharge
Insert new supporting Appendix material **A3.6.2.1**
Example Number 1 , Sikorski S-61R, overall length of 22.2M
(Radius of minimum pad) X (Radius of minimum pad) X π
(22.2M / 2) X (22.2M 2) X 3.1416
11.1 X 11.1 X 3.1416
123.21 X 3.1416 = 387M2
For this example the minimum foam discharge of the fixed system shall be at the appropriate flow for the type of foam utilized and capable of covering at least 387M2
Example Number 2 , Bell 412, overall length of 17.1M
(Radius of minimum pad) X (Radius of minimum pad) X π
(17.1M / 2) X (17.1M X 2) X 3.1416
8.55 X 8.55 X 3.1416
73.1 X 3.1416 = 230M2
For this example the minimum foam discharge of the fixed system shall be at the appropriate flow for the type of foam utilized and capable of covering at least 230M2
3.6.3*
The area of application of foam discharge for hose line systems shall be the practical critical fire area for the category of the helicopter landing facility, as shown in Table 3.6.3. The duration shall be 2 minutes.



Area exceeding the overall length of the helicopter

Area requiring foam coverage from the fixed system

Substantiation: **Statement of problem with current standard**
The current standard discourages the installation of fixed foam fire protection systems, as the required water flow at the rooftop is difficult to achieve and prohibitive. This modification is aimed at promoting the utilization of both a fixed system for the landing pad area for a quick knockdown of the bulk of the fire, and by a hose reel foam capability to complete extinguishment and control of the fire.

Substantiation
Some regulatory jurisdictions prescribe a landing pad to be bigger than the minimum size prescribed in the US. A larger landing pad is considered to provide a higher level of operational safety. Therefore, requiring the operators of those facilities to provide full foam coverage for 5 minutes may preclude the building of bigger/safer rooftop landing pad facilities.

References quotations: Illustrating the different sizes requiring foam coverage.

ICAO Annex 14 volume 2 "Roof top Helideck 1.5 times the overall length"

FAA AC 150/5390-2-A Private heliports " The least dimension of a TLOF should be a minimum of 1.5 times the length or width of the undercarriage of the design helicopter, whichever is greater"

FAA AC 150/5390-2-A Public heliports "The recommended minimum dimension of the TLOF should not be less than the rotor diameter of the design helicopter"

Canadian regulation "Rooftop Helideck 1 times the overall length"

Committee Meeting Action: Reject
Committee Statement: The application area for fixed discharge outlet systems in 3.6.2 is the entire rooftop landing pad. This requirement is based on a typical landing pad which would only take up a portion of the rooftop under normal circumstances. The duration of 5 minutes is intended to apply a foam blanket over the entire landing pad surface.

The requirement in 3.6.2 is quite different from 3.6.3 since there must be trained individuals arriving within a reasonable response time. The foam duration is 2 minutes for 3.6.2 since the fire fighters would be applying the foam early in the fire scenario and directly to the area where the fire occurs. The fire fighters would be able to conserve the foam and have foam available in the event of a reflash.

The recommendation mixes these two approaches where only one should apply.

Also see Proposal 418-12 (Log #CP11).

418-14 Log #CP6 **Final Action: Accept**
(3.6.2)

Submitter: Technical Committee on Helicopter Facilities
Recommendation: Change the title of Table 3.6.3 to read as follows:
Table 3.6.3 Practical Critical Areas for Hose Line Systems Only
Substantiation: Clarification.
Committee Meeting Action: Accept

418-15 Log #CP8 **Final Action: Accept**
(3.6.2.1)

Submitter: Technical Committee on Helicopter Facilities
Recommendation: Add 3.6.2.1 to read as follows:
3.6.2.1 A fixed discharge outlet system shall be either fixed stationary nozzles around the perimeter or one or more oscillating monitor/nozzle(s).
Substantiation: Clarification.
Committee Meeting Action: Accept

418-16 Log #CP7 **Final Action: Accept**
(3.7)

Submitter: Technical Committee on Helicopter Facilities
Recommendation: Delete 3.7.
Substantiation: The NFPA Fire Protection Handbook Provides the following statement:
Members of the fire protection community have historically disagreed about the desirability of having standpipe systems available for occupant use. Concerns focus on the ability of untrained occupants to safely use a 100-ft (30.5 m) long flowing up to 100 gpm (378 L/min) and on the wisdom of encouraging occupants to fight a fire instead of evacuating. These concerns have led to a trend of reducing the requirements for, or eliminating the installation of, standpipe systems with preconnected hoses. Consequently, the use of Class II systems is declining.
Committee Meeting Action: Accept

418-17 Log #7 **Final Action: Accept in Principle**
(3.9 (New))

Submitter: James Everitt, Western Regional Fire Code Development Committee
Recommendation: Add a new section to read:
3.9 A means of communication shall be provided from the roof area to notify the fire department of emergencies. Alternatively, a fire alarm pull station shall be installed and connected to the fire alarm system, if applicable, and identified as a separate zone.
Substantiation: A readily available means of communicating an emergency happening on a rooftop heliport should be available. If a building has a fire alarm system installed, then a manual fire alarm station shall be installed.
Committee Meeting Action: Accept in Principle
Revise 3.8 to read as follows:
3.8 Fire Alarm. A means of communication shall be provided from the roof area to notify the fire department of emergencies. Where buildings are provided with a fire alarm system, a manual pull station shall be provided for each designated means of egress from the roof. (See 3.4.1.)
Committee Statement: The committee agrees with the need to provide a means of communication to notify the fire department.

418-18 Log #8 **Final Action: Accept**
(8.1.2.2)

Submitter: Bob Eugene, Underwriters Laboratories Inc.
Recommendation: Revise text to read:
8.1.2.2 UL Publication. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.
UL 162, Standard for Foam Equipment and Liquid Concentrates, 1994 with revisions through September 1999 .
Substantiation: Update to current edition of referenced standard.
Committee Meeting Action: Accept

418-19 Log #CP12 **Final Action: Accept**
(A.3.1)

Submitter: Technical Committee on Helicopter Facilities
Recommendation: Add the following new text:
A.3.1 Where the landing pad is nonporous, fuel tight, provided with a proper drainage system, and where fuel cannot flow to support members, the main structural support members would not need to be fire rated.
Substantiation: Clarification.
Committee Meeting Action: Accept

NFPA 418

Standard for Heliports

2006 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

Information on referenced publications can be found in Chapter 2 and Annex D.

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard specifies the minimum requirements for fire protection for heliports and rooftop hangars.

1.1.2 This standard does not apply to ground-level helicopter hangars.

1.1.3 All hangars not covered by this standard are required to comply with NFPA 409, *Standard on Aircraft Hangars.*

1.1.4 Temporary landing sites and emergency evacuation facilities are outside the scope of this standard.

1.2* Purpose. The purpose of this standard is to establish minimum fire safety requirements for operation at heliports for the protection of persons, aircraft, and other property.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2002 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2002 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 2003 edition.

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2003 edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, 2003 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2003 edition.

NFPA 70, *National Electrical Code®*, 2005 edition.

NFPA 99, *Standard for Health Care Facilities*, 2002 edition.

NFPA *101®*, *Life Safety Code®*, 2003 edition.

NFPA 220*, Standard on Types of Building Construction*, 1999 edition.

NFPA 407, *Standard for Aircraft Fuel Servicing*, 2001 edition.

NFPA 409, *Standard on Aircraft Hangars*, 2004 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 2004 edition.

2.3 Other Publications.

2.3.1 FAA Publication. Federal Aviation Administration, Department of Transportation, Distribution Unit, M-494.3, Washington, DC 20590.

FAA A/C 150/5390-2A, *Heliport Design Advisory Circular,* January 20, 1994.

2.3.2 UL Publication. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

UL 162, *Standard for Foam Equipment and Liquid Concentrates*, 1994 with revisions through September 1999. **(ROP 18)**

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary,* 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction(AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.4 Shall. Indicates a mandatory requirement.

3.2.5 Should. Indicates a recommendation or that which is advised but not required.

3.2.6 Standard. A document, the main text of which contains only mandatory provisions using the word ìshallî to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

3.3 General Definitions.

3.3.1 Area.

3.3.1.1* Critical Area. The area calculated to be one-half the overall length of the helicopter multiplied by three times the width of the widest portion of the fuselage.

3.3.1.2 Helicopter Storage and Servicing Area. That part of a rooftop hangar normally used for the storage and servicing of one or more helicopters, not including any adjacent or contiguous areas or structures, such as shops, storage areas, and offices.

3.3.1.3* Practical Critical Fire Area (PCA). The area, for foam discharge purposes, calculated as one-half the fuselage length multiplied by three times the fuselage width.

3.3.2 Critical Area. See 3.3.1.1.

3.3.3 Emergency Evacuation Facility. A designated and clear area at rooftop or ground level intended exclusively for emergency/rescue operations by helicopters.

3.3.4* Foam Fire-Extinguishing System. A low-expansion foam fire-extinguishing system.

3.3.5 Helicopter Storage and Servicing Area. See 3.3.1.2.

3.3.6 Helipad Support Structure. A structure used for helipad and/or helicopter maintenance or storage that is not classified as a rooftop hangar.

3.3.7* Heliport. An identifiable area located on land, on water, or on a structure that also includes any existing buildings or facilities thereon, used or intended to be used for landing and takeoff of helicopters.

3.3.7.1 Offshore Landing Heliport. A heliport located on fixed or mobile structures and vessels in a marine environment that do not have means of entry and egress connected directly to shore.

3.3.8 Overall Length. The length of a helicopter from the main rotor fully extended to the tail rotor fully extended.

3.3.9 Practical Critical Fire Area (PCA). See 3.3.1.3.

3.3.10 Rooftop Hangar. A structure on top of a building where helicopters are housed, stored, or maintained.

3.3.11 Rooftop Landing Pad. The entire load-bearing surface intended for the touchdown and lift off (TLOF) of helicopters.

3.3.12 Temporary Landing Site. A site intended to be used for a period of less than 30 consecutive days, and for no more than 10 operations per day.

Chapter 4 General Requirements — Land-Based Facilities

4.1 General. The requirements in this chapter shall apply to all land-based facilities. *(See Chapter 8 for offshore heliports.)* **(ROP 5)**

4.2* Plans. Plans for construction and protection of heliports shall be approved by the authority having jurisdiction.

4.3 Tank Locations.

4.3.1 Storage, handling, and use of flammable and combustible liquids shall be in accordance with NFPA 30, *Flammable and Combustible Liquids Code.*

4.3.2 Oxygen and other medical gases shall be stored and used in accordance with 4.3.1.1.2(a)(5) and 9.3.1.11.2(b) and 9.3.1.11.2(c) of NFPA 99, *Standard for Health Care Facilities.*

4.3.3 Aboveground flammable liquid storage tanks, compressed gas storage tanks, and liquefied gas storage tanks shall be laterally located at least 50 ft (15.2 m) from the edge of the final approach and takeoff (FATO) area as defined in FAA A/C 150/5390-2A, *Heliport Design Advisory Circular.*

4.4 Fire-Fighting Access.

4.4.1 The heliport shall have at least one access point for fire-fighting/rescue personnel, and, where practical, a second access point shall be available and located remotely from the other.

4.4.2 Fences shall not prevent access by fire-fighting/rescue personnel.

4.5 Landing Pad Pitch. The heliport shall be pitched or sloped so that drainage flows away from access points and passenger holding areas.

4.6 No Smoking.

4.6.1 No smoking shall be permitted within 50 ft (15.2 m) of the landing pad edge.

4.6.2 No smoking signs shall be erected at access/egress points to the heliport.

4.7 Fueling System. Fueling systems shall be designed in accordance with NFPA 407, *Standard for Aircraft Fuel Servicing.*

4.7.1 Fixed fueling dispensing equipment shall be located outside of rooftop hangars.

4.7.2 Fueling equipment shall not hinder or obstruct access to exits or fire-fighting equipment.

4.7.3 Fuel pump manifolds shall be located 25 ft (7.6 m) from rooftop hangars and fixed fire protection equipment.

Chapter 5 Rooftop Landing Facilities — ~~Additional Protection~~ (ROP 5)

5.1 General. The requirements in Chapters 4 and 5 shall apply to all rooftop landing facilities. **(ROP 5)**

5.2* Structural Support. Main structural support members that could be exposed to a fuel spill shall be made fire resistant using listed materials and methods to provide a fire-resistance rating of not less than 2 hours.

5.3 Landing Pad Pitch. The rooftop landing pad shall be pitched to provide drainage at a slope of 0.5 percent to 2 percent.

5.3.1 The pitch of the pad shall be designed to protect, at a minimum, the primary egress path, passenger holding area, rooftop hangar, and fire protection activation systems.

5.3.2 Drainage flow shall not penetrate alternate egress points, stairways, ramps, hatches, and other openings not designed for drainage.

5.4 Landing Pad Construction Materials.

5.4.1 The rooftop landing pad surface shall be constructed of noncombustible, nonporous materials that are approved.

5.4.2 The contiguous building roof covering within 50 ft (15.2 m) of the landing pad edge shall have a Class A rating.

5.5* Means of Egress. At least two approved means of egress from the rooftop landing pad edge to the roof shall be provided and shall be remotely located from each other. **(ROP 6)**

5.5.1 For heliports occupied by 50 or more people, two approved means of egress from the roof shall be provided and shall be remotely located from each other, but shall not be located less than 30 ft (9.1 m) from each other.

5.5.2 For heliports occupied by fewer than 50 people, one approved means of egress from the roof shall be provided.

5.5.3 Means of egress from the rooftop landing pad and roof shall not obstruct flight operations.

5.6 Fire-Fighting Access.

5.6.1 The helicopter rooftop landing pad shall have at least two access points for fire-fighting purposes.

5.6.2 Access for fire-fighting personnel through the landing pad egress shall be permitted.

5.6.3* Where required by the authority having jurisdiction, access to the building's interior shall be provided through each required exit stairway that extends onto the roof. **(ROP 8)**

5.7 Fire Protection. A foam fire-extinguishing system with either a fixed discharge outlet(s) in accordance with 5.7.3 or a hose line(s) in accordance with 5.7.4 shall be designed and installed to protect the rooftop landing pad, unless otherwise permitted by the following: **(ROP 10)**

~~(1) A foam fire-extinguishing system shall not be required for heliports located on parking garages, unoccupied buildings, or other similar unoccupied structures.~~

(1) A foam fire extinguishing system shall not be required for heliports located on open parking structures or buildings that are not normally occupied. **(ROP 9)**

(2) For H-1 heliports, two portable foam extinguishers, each having a rating of 20-A:160-B, shall be permitted to be used to satisfy the requirement of Section 5.7.

5.7.1 Where trained personnel are not available, fixed fire protection outlet(s) shall be provided. **(ROP 12)**

5.7.2* The foam discharge rate shall be as shown in Table 5.7.2.

Table 5.7.2 Foam Discharge Rates For Fixed Discharge Systems Only (ROP 11)

Foam	Discharge Rate	
	gpm/ft^2	mm/min
AFFF	0.10	4.1
Fluoroprotein	0.16	6.5
Protein	0.20	8.1

5.7.3 The area of application of foam discharge for fixed discharge outlet systems shall be the entire rooftop landing pad for a duration of 5 minutes.

5.7.4* The area of application of foam discharge for hose line systems shall be the practical critical fire area for the category of the helicopter landing facility in accordance with Table 5.7.4 for a duration of 2 minutes.

Table 5.7.4 Practical Critical Fire Areas For Hoseline Systems Only (ROP 14)

Category	Helicopter Overall Length†	Practical Critical Fire Area	
		ft^2	m^2
H-1	Up to but not including 50 ft (15.2 m)	375	34.8
H-2	From 50 ft (15.2 m) up to but not including 80 ft (24.4 m)	840	78.0
H-3	From 80 ft (24.4 m) up to but not including 120 ft (36.6 m)	1440	133.8

†Helicopter length, including the tail boom and the rotors.

5.7.4.1 A fixed discharge outlet system shall be either fixed stationary nozzles around the perimeter or one or more oscillating monitor/nozzle(s). **(ROP 15)**

5.7.5 The water supply for the foam system shall be from a source approved by the authority having jurisdiction.

5.7.5.1 Fire pumps, if used, shall be installed in accordance with NFPA 20*, Standard for the Installation of Stationary Pumps for Fire Protection*.

5.7.5.2 Standpipes and hose stations, if used, shall be installed in accordance with NFPA 14, *Standard for the Installation of Standpipe and Hose Systems.*

5.7.5.3 Where freezing is possible, freeze protection shall be provided.

5.7.6 The foam components shall be installed in an area of the heliport and shall not penetrate the approach takeoff surface, transitional surfaces, and safety area as defined in FAA A/C 150/ 5390-2A, *Heliport Design Advisory Circular.*

5.7.7 At facilities where there is more than one rooftop landing pad, the supply of foam available shall be sufficient to cover an incident on at least one of the pads.

5.7.8 Where fixed foam systems utilizing fixed deck nozzles or oscillating foam turrets, or both, are installed, system components shall be listed or approved.

~~**5.8 Standpipes.** If a building with a rooftop heliport is supplied with a standpipe system, a Class II standpipe installed in accordance with NFPA 14, *Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems*, shall be extended to the roof level on which the rooftop heliport is located.~~ (ROP 16)

5.8 Fire Alarm. A means of communication shall be provided from the roof area to notify the fire department of emergencies. **(ROP 17)**

5.8.1 Where buildings are provided with a fire alarm system, a manual pull station shall be provided for each designated means of egress from the roof. *(See 5.5.1.)*

Chapter 6 Rooftop Hangars

6.1 Construction.

6.1.1 Building construction of the rooftop hangar shall be as a minimum Type II (111) construction in accordance with NFPA 220, *Standard on Types of Building Construction*, except for the floor, which shall have a minimum 2-hour fire resistance rating.

6.1.2 Other helicopter support operations within the rooftop hangar, such as offices, medical supplies, gas storage, and fire protection equipment, shall meet the following criteria:

(1) They shall be separated by walls and ceilings having a minimum fire resistance rating of 1 hour.

(2) They shall have openings protected by listed fire doors or shutters having a minimum fire resistance rating of 45 minutes.

6.1.3 Partitions and ceilings separating rooftop hangars from other building occupancies shall have a minimum fire resistance rating of 2 hours, and doors shall have a minimum fire resistance rating of 1 1/2 hours.

6.1.4 Means of egress shall be in accordance with NFPA *101*, *Life Safety Code.*

6.1.4.1 Egress doors for personnel that do not require the opening of doors accommodating aircraft shall be provided in each partitioned space.

6.1.4.2 Intervals between doors shall not exceed 150 ft (45 m) on all exterior walls or 100 ft (30 m) along interior walls.

6.1.4.3 Egress/access points to and from the roof shall be marked.

6.2 Rooftop Hangar Floor Drainage.

6.2.1 Floor drainage systems shall be provided to restrict the spread of fuel in order to reduce the fire and explosion hazards from fuel spillage.

6.2.2 Drainage systems shall use metallic pipe, drained to a safe location meeting one of the following criteria:

(1) The system shall be designed with traps.

(2) The system shall be provided with ventilation to prevent vapor mixtures from forming within the underground drainage system.

6.2.3 Drainage systems in helicopter storage and servicing areas shall be designed and constructed so that they have capacity to prevent buildup of flammable liquids and water over the drain inlet when fire protection systems and hose streams are discharging at the design rate.

6.2.4 The pitch of the rooftop hangar floor shall be a minimum of 1/2 of 1 percent.

6.2.5 The floor pitch provided shall be calculated taking into consideration the towing requirements, helicopter weight, maintenance, and so forth.

6.2.6 Curbs, ramps, or drains shall be provided at all openings from helicopter storage and servicing areas, or the slope of the floor shall be such as to prevent the flow of liquids through the openings.

6.2.7 Pits for service facilities, such as for compressed air and electrical outlets, shall drain into the floor drainage system.

6.2.8 Grates and drain covers shall be of sufficient strength to support the point loading of the heaviest type of helicopter or equipment that the rooftop hangar serves.

6.2.9 Grates and covers shall be removable to facilitate cleaning and flushing.

6.3 Suspended or Elevated Heaters. In helicopter storage and servicing areas, listed electric, gas, or oil heaters shall be permitted and shall be installed at least 10 ft (3 m) away from the helicopter engines.

6.4 Lighting and Electrical Systems.

6.4.1 Artificial lighting shall be restricted to electrical lighting.

6.4.2 Installations of electrical equipment shall be in compliance with the provisions for aircraft hangars contained in Article 513 of NFPA 70, *National Electrical Code®*.

6.5 Lightning Protection. Where provided, lightning protection shall be installed in accordance with NFPA 780, *Standard for the Installation of Lightning Protection Systems.*

6.6 Protection of Helicopter Rooftop Hangars.

6.6.1 Helicopter storage and servicing areas shall be protected by an AFFF foam water sprinkler system designed, installed, and tested in accordance with NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems.*

6.6.2 Foam concentrate shall meet the requirements of UL 162, *Standard for Foam Equipment and Liquid Concentrates.*

6.6.3 All other areas of the rooftop hangar shall be protected by water sprinkler systems designed, installed, and tested in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

6.7 Portable Fire Extinguishers for Rooftop Hangars.

6.7.1 Portable fire extinguishers for rooftop hangars shall be provided in accordance with NFPA 10, *Standard for Portable Fire Extinguishers.*

6.7.2 In helicopter storage and service areas, the distribution of fire extinguishers shall be in accordance with the extra hazard classification of NFPA 10, *Standard for Portable Fire Extinguishers.*

Chapter 7 Water Supply

7.1* Calculation of Water Supply for Foam Systems. Where foam systems are provided for the rooftop landing pad area and rooftop hangar, the water supply shall be calculated based on the demand for the largest system.

Chapter 8 Offshore Heliports

8.1* Plans. Plans for construction and protection of heliports located on fixed and mobile offshore installations shall be approved by the authority having jurisdiction.

8.2 Fire-Fighting Access.

8.2.1 The heliport shall have at least one access point for fire-fighting/rescue personnel.

8.2.2 Where practical, a second access point shall be available and shall be located remotely from the other.

8.3 Landing Pad Pitch. Heliports shall be designed to prevent the standing collection of liquids and to prevent liquids from spreading to or spilling on accommodation spaces or working spaces.

Chapter 9 Portable Fire Extinguishers

9.1 Quantity and Rating.

9.1.1 At least one portable fire extinguisher as specified in Table 9.1.1 shall be provided for each takeoff and landing area, parking area, and fuel storage area, unless otherwise permitted by 9.1.2.

9.1.2 The requirement of 9.1.1 shall not apply to unattended ground level heliports.

Table 9.1.1 Minimum Ratings of Portable Fire Extinguishers for Heliport Categories

Category	Helicopter Overall Length†	Minimum Rating
H-1	Up to but not including 50 ft (15.2 m)	4-A:80-B
H-2	From 50 ft (15.2 m) up to but not including 80 ft (24.4 m)	10-A:120-B
H-3	From 80 ft (24.4 m) up to but not including 120 ft (36.6 m)	30-A:240-B

†Helicopter length, including the tail boom and the rotors.

9.2 Servicing. Portable fire extinguishers shall comply with NFPA 10, *Standard for Portable Fire Extinguishers*, Chapters 1, 4, 5, and 6.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.2 See Annex B.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.3 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.1.1 Critical Area. See Annex C for additional information.

A.3.3.1.3 Practical Critical Fire Area (PCA). See also Annex C.

A.3.3.4 Foam Fire-Extinguishing System. A foam fire-extinguishing system can be a fixed discharge outlet system utilizing fixed storage and piping connected to fixed outlets or monitor nozzles and manually activated by pushing a button on a console or a pull station. It also can be a hose line system connected to fixed storage.

A.3.3.7 Heliport. The term *heliport* applies to all sites used or intended to be used for the landing and takeoff of helicopters.

A.4.2 FAA A/C 150/5390-2A, *Heliport Design Advisory Circular*, contains design and construction information on heliports. This advisory circular provides for adequate clearance between operating aircraft and buildings or structures located at the heliport. The FAA advisory circular should be consulted to ensure that adequate safe practice and facilities are maintained.

A.5.2 Where the landing pad is nonporous, fuel tight, and provided with a proper drainage system, and where fuel cannot flow to support members, the main structural support members would not need to be fire rated. **(ROP 19)**

A.5.5 For further information on exit principles, see NFPA *101*, *Life Safety Code.*

A.5.6.3 Where doors accessing the interior of the building are locked, an approved means should be provided for entry of emergency responders. **(ROP 8)**

A.5.7.2 Where personnel trained in the operations of the equipment are in attendance, a hose line system is preferred. *(Also see Annex C.)*

A.5.7.4 The area of application and the duration where using a hose line system is reduced because foam is applied efficiently and directly on the fire by trained personnel.

A.7.1 The water supply is not intended to be based on simultaneous operation of both systems.

A.8.1 The design of heliports located on fixed or mobile offshore installations generally is based on landing sites of steel construction. However, in no way should this be construed as a recommendation of steel over other suitable building material.

Annex B Heliport Emergency Planning and Training for Safety Personnel

B.1 General. If safety personnel are provided at a heliport, the heliport operator should provide initial and recurrent training aimed at providing the safety personnel with the knowledge and skills necessary to deal effectively with an emergency at a heliport.

B.1.1 The training should address, at least, the following subjects:

(1) Operation of the heliport
(2) Safety procedures around helicopters during ground operations
(3) Communication systems at the heliport
(4) Heliport emergency plan

B.1.2 Heliport emergency planning is the process of preparing a heliport to cope with an emergency that takes place at the heliport or in its vicinity. The following are examples of heliport emergencies:

(1) Aircraft emergencies, such as crashes on or off the heliport
(2) Medical emergencies
(3) Dangerous goods occurrences
(4) Fires
(5) Natural disasters

B.1.3 The purpose of heliport emergency planning is to minimize the impact of an emergency by saving lives and maintaining aircraft operations.

B.1.4 The heliport emergency plan sets out the procedures for coordinating the response of heliport agencies or services (e.g., air traffic services unit, fire-fighting services, heliport administration, medical and ambulance services, aircraft operators, security services, and police) and the response of agencies in the surrounding community (fire departments, police, medical and ambulance services, hospitals, military, and harbor patrol or Coast Guard) that could be of assistance in responding to the emergency.

B.1.4.1 A heliport emergency response plan should be established at a heliport.

B.1.4.2 The plan should identify agencies that, in the opinion of the heliport operator, could be of assistance in responding to an emergency at the heliport or in its vicinity.

B.1.4.3 The plan should specify the procedures for at least the following emergencies:

(1) Aircraft crash or other accident within the heliport perimeter
(2) Aircraft crash outside the heliport perimeter
(3) Trauma injury to personnel
(4) Medical emergencies

B.1.4.4 Where an approach/departure path at a heliport is located over water, the plan should identify which agency is responsible for coordinating rescue in the event of an aircraft ditching and indicate how to contact that agency.

B.1.4.5 The plan should include, at a minimum, the following information:

(1) Types of emergencies planned for
(2) How to initiate the plan for each emergency specified

(3) Names of agencies on and off the heliport to contact for each type of emergency, with telephone numbers or other contact information

(4) Role of each agency responding to each type of emergency

(5) List of pertinent and available on-heliport services with telephone numbers or other contact information

(6) Copies of any agreements with other agencies for mutual aid and the provision of emergency services

(7) Grid map of the heliport and its immediate vicinity

(8) Use of any of the following equipment, if that equipment is provided at the heliport:

(a) Portable extinguishers

(b) Fire hoses, nozzles, and other similar appliances

(c) Extinguishing agents

B.1.4.6 A heliport operator should consult all agencies identified in the plan about their role in the plan.

B.1.4.7 The plan should be reviewed and the information in it updated yearly by the heliport operator.

B.1.4.8 A test of the emergency response plan should be carried out at least once every 3 years at a heliport that provides a scheduled service for the transport of passengers.

B.1.4.9 At a rooftop heliport, at least one person who has received the training described in this annex should be available during aircraft operations.

Annex C Establishing Extinguishing Agent Quantities and Discharge Rates

C.1 Introduction. The calculations used to develop the minimum extinguishing agent quantities and discharge rates presented in Table C.1(a) and Table C.1(b) for rooftop heliports include the factors specified in C.1.1 through C.1.4.

C.1.1 Aircraft Size. This factor reflects the potential level of risk (e.g., passenger load), the potential fire load (e.g., fuel capacity), and the dimensions (i.e., fuselage length and width), that allow the identification of a meaningful operational objective [i.e., the area to be rendered fire-free (controlled or extinguished)].

C.1.2 Relative Effectiveness of Agent Selected. This factor is represented by the specific application rate identified for each of the common generic foam concentrate types.

C.1.3 Time Required to Achieve Control. Large-scale fire tests, empirical data, and field experience indicate that 1 minute is both a reasonable and a necessary operational objective.

C.1.4 Time Required to Maintain Controlled Area Fire-Free. This factor is an operational objective that provides a safety factor for the initial fire attack while waiting for the arrival of backup support.

C.2 Calculation Method History.

C.2.1 The calculation method is supported by research and experimental work done mainly at the United States FAA Technical Center. It was developed by the Rescue and Firefighting Panel II (RFFP II), a group of international experts in the field, convened by the International Civil Aviation Organization, Montreal Canada, circa 1970.

C.2.2 The RFFP II initially focused on the concept of the theoretical critical fire area, which was identified in the FAA's large-scale fire tests as ". . . the area adjacent to the fuselage extending outward in all directions to a limit beyond which a large fuel fire would not melt an aluminum fuselage, regardless of the fire exposure time." For this concept to be useful, specific information about the size of the area was needed. Again, using the FAA Technical Center's work as a basis, the RFFP II defined the theoretical critical fire area (TCA) as "the area adjacent to an aircraft in which fire must be controlled."

Table C.1(a) Method to Determine Helicopter Critical Fire Area and Required Minimum Amount of Water for a Hose Line (AFFF) System

NFPA/ICAO Heliport Category				1/2 O.L. of Largest Helicopter*		Fuselage Width Tripled†		Practical Critical Fire Area		Application Rate		Q_1 Water to Control within 1 Minute		Q_2 Reserve to Extinguish		Q Total Water to Extinguish
	(ft)		(ft)	(ft)		(ft)		(ft^2)		(gpm/ft^2)		(gal)		(%)		(gal)
H-1	0	<	50	25	×	15	=	375	×	0.10	=	37.5	+	100	=	75
H-2	50	<	80	40	×	21	=	840	×	0.10	=	84	+	100	=	168
H-3	80	<	120	60	×	24	=	1440	×	0.10	=	144	+	100	=	288

*O.L.: Overall length, measured from tip of main rotor fully extended to tip of tail rotor fully extended.

†Fuselage width: Actual fuselage width (does not include landing gear) measured from outside of cabin.

Q = minimum agent volume for effective fire service operations

Q_1 = volume of agent needed for 1-minute control of *PCA*

Q_2 = volume of agent needed for continued control or complete extinguishment of fire related to *PCA*, or both

C.3 Formulas. The definition of TCA implies control of the fire within a specific area. In order to achieve this, dimensions need to be determined. The formulas that follow were developed from that earlier work. Using these formulas, the size of the area of interest can be calculated. For example,

Table C.1(b) Method to Determine Helicopter Critical Fire Area and Required Minimum Amount of Water for a Hose Line (AFFF) System (SI units)

NFPA/ICAO Heliport Category				1/2 O.L. of Largest Helicopter*		Fuselage Width Tripled†		Practical Critical Fire Area		Application Rate		Q_1 Water to Control within 1 Minute		Q_2 Reserve to Extinguish		Q Total Water to Extinguish
	(m)		(m)	(m)		(m)		(m^2)		mm/min		(L)		(%)		(L)
H-1	0	<	15.2	7.6	×	4.6	=	34.8	×	4.1	=	141.9	+	100	=	283.8
H-2	15.2	<	24.4	12.2	×	6.4	=	78.0	×	4.1	=	317.9	+	100	=	635.8
H-3	24.4	<	36.6	18.3	×	7.3	=	133.8	×	4.1	=	545.0	+	100	=	1090

*O.L.: Overall length, measured from tip of main rotor fully extended to tip of tail rotor fully extended.

†Fuselage width: Actual fuselage width (does not include landing gear) measured from outside of cabin.

If L is less than 65 ft,

$$TCA = L \times W)$$

or

$$TCA = L \times W)$$

If L is greater than 65 ft,

$$TCA = L \times (100 \text{ ft} + W)$$

or

$$TCA = L \times (30 \text{ m} + W)$$

where:

TCA = theoretical critical fire area

L = average aircraft length

W = average width of aircraft served at the airport of interest

C.3.1 Conceptually, the TCA serves as a means for assessing the magnitude of the potential fire hazard of the aircraft accident environment. It *does not represent* the average, maximum, or minimum spill fire size associated with a particular aircraft. However, it does represent a starting point for determining realistic fire-extinguishing agent requirements. The formulas allow for the calculation of the TCA area for different sizes of aircraft. The formulas are widely accepted throughout the aircraft fire service community and are applied as described in C.3.2 through C.3.12.

C.3.2 A 1970 study concluded that in survivable aircraft crashes a practical fire area should be considered that was smaller than the theoretical area. Detailed criteria for the practical fire area and the related quantities of extinguishing agents were formulated during the second meeting of the RFFP II. In developing its material, the panel included a study of the quantities of agents used on actual fires. In 99 out of 106 such fires, the quantities of agents used were less than those recommended by the theoretical critical fire area calculations.

C.3.3 As a result of the study, RFFP II developed material recommending that the practical area be approximately two-thirds the theoretical area *[see Figure C.3.3]*. This principle has been adopted by the ICAO, the NFPA, and the U.S. FAA in the development of tables that show extinguishing agent volumes for their respective standards and recommended practices. The practical critical fire area (PCA) for fixed-wing aircraft is commonly expressed as follows:

$$PCA = (0.67)(TCA)$$

where:

PCA = practical critical fire area

TCA = theoretical critical fire area

Figure X.3.3 Practical Critical Fire Area Relative to Theoretical Critical Fire Area. [Existing Figure A.3.6.1(a), 2001 ed., (no change)]

C.3.4 In adapting the fixed-wing fire protection methodology to helicopters, the committee considered the additional factors described in C.3.4.1 through C.3.4.4 that make the fire protection problem of helicopters (rotary-wing aircraft) unique.

C.3.4.1 Occupied Space. Relative to its fixed-wing counterpart, a smaller portion of the overall aircraft length is occupied.

C.3.4.2 Fuel Quantities and Location. Fuel tanks are not located in the "wings" or rotor blades, and relatively small quantities of fuel are involved.

C.3.4.3 Impact Energy. Relative to the fixed-wing counterpart, a helicopter accident generally occurs at slow ground speeds.

C.3.4.4 Expected Aircraft Size. In general, heliports are designed for the largest helicopter expected to utilize the facility, not the median size for the category. *(See Table 5.6.4.)*

C.3.5 After considering the factors involved in the fixed-wing methodology and those factors that are unique to helicopters, the committee arrived at a theoretical critical area for helicopters that includes a longitudinal dimension of one-half the overall length of the helicopter and a width equal to three times the fuselage width. In addition, in the absence of any data that suggested a more appropriate alternative, the practical critical fire area has been determined to be 100 percent of the theoretical critical area. *[See Figure C.3.5.]*

Figure C.3.5 Practical Critical Fire Area for Helicopters. [Existing Figure A.3.6.1(b), 2001 ed., (no change)]

C.3.6 Another established principle is the distinction between control and extinguishment of a fire. Test data and a wide range of field experience indicate that the quantities of foam agent needed to control and extinguish an aircraft fire should be determined separately. This principle is expressed in the following calculation method, which provides the minimum agent volume for effective fire service operations:

$$Q = Q_1 + Q_2$$

where:

Q = minimum agent volume for effective fire service operations

Q_1 = volume of agent needed for 1-minute control of PCA

Q_2 = volume of agent needed for continued control or complete extinguishment of fire related to PCA, or both

C.3.7 The relationship between Q_1 and Q_2 as they were developed by the committee that studied the fixed-wing fire protection problem is as follows:

Q_1 = (application rate) × (practical critical area)

or

$$Q_1 = (AR)(PCA)$$

C.3.8 Where the application rate (AR) is the unit volume of agent applied to a unit area of fire in a unit time (the exact units such as gpm/ft^2 or mm/min depend on the units convention being used), the volume of agent needed for continued control or complete extinguishment of fire is as follows:

$$Q_2 = f(Q_1)$$

And, it has been determined that, for all categories of heliports, $f = 1$.

Therefore:

$$Q = 2[(AR)(PCA)]$$

C.3.9 A sample calculation of the total water quantity, Q, needed where aqueous film-forming foam concentrate is to be used at each of the three categories of heliport is provided in Table C.1(a) and Table C.1(b). A similar set of water quantities can be calculated for any other foam concentrate for which an accepted application rate is known. The value for the AFFF application rate in column 5 of Table C.1(a) and Table C.1(b) is substituted, and the indicated calculations are performed to obtain the value of Q for the specific foam concentrate to be used.

C.3.10 To fully appreciate the significance and simplicity of this methodology as a means of determining levels of fire protection, it should be clearly understood that Q_1 is only that minimum quantity of fire-fighting agent required for 1-minute fire control (90 percent extinguishment) of the anticipated practical critical fire area. Therefore, any fire and rescue service cannot be expected to perform an effective rescue effort where equipped with less than the quantity of primary extinguishing agent specified by the volume of Q_1 for the specific airport/heliport category. Furthermore, a fire suppression/rescue mission that is initiated using the required minimum application rate and is continued at that rate, while effectively extinguishing fire or securing unburned fuel within the practical area, ceases operations at the end of 1 minute. In other words, the agent specified by the volume Q_1 is depleted. There is no agent available for mop-up activities, foam blanket repair, or standby protection for continued rescue or salvage activities. Therefore, while the control volume Q_1 provides an operational significance that is critical to the rescue operation, it is, at the same time, limited.

C.3.11 It should be clear, therefore, that in order to extend an effective fire suppression and rescue operation beyond the initial 1-minute fire control period, an additional volume of foam agent, Q_2, needs to be available. This volume of agent is used to repair foam blanket damage that might be caused by evacuees and rescue workers walking through the foamed areas or by hot surfaces created by the initial fire. Furthermore, Q_2 is needed to extinguish all fire in the practical critical fire area and those fires outside the practical critical area that initially are determined to pose no threat to life.

C.3.12 Agent quantity in accordance with Q_2 also provides standby protection before total extinguishment during interior aircraft search operations and for the removal of immobile survivors after fire

control. It also is used for securing the fire area during initial aircraft salvage operations immediately after total fire extinguishment. Therefore, an aircraft fire service equipped with only the 1-minute fire control volume represented by Q_1 is expected to assume a significant level of risk. That risk cannot be considered a "calculated risk" unless the manager selecting the reduced agent volume knows the nature of the fire area and the potential hazard involved.

Annex D Informational References

D.1 Referenced Publications. The following documents or portions thereof are referenced within this standard for informational purposesonly and are thus not part of the requirements of this document unless also listed in Chapter 2.

D.1.1 NFPA Publication. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA *101*®, *Life Safety Code*®, 2003 edition.

D.1.2 Other Publications.

D.1.2.1 FAA Publication. Federal Aviation Administration, Department of Transportation, Distribution Unit, M-494.3, Washington, DC 20590.

FAA A/C 150/5390-2A, *Heliport Design Advisory Circular*, January 20, 1994.

D.1.2.2 ICAO Publication. International Civil Aviation Organization, Montreal, Canada.

Rescue and Firefighting Panel II (RFFP II), Research and experimental work, circa 1970.

D.2 Informational References. (Reserved)

D.3 References for Extracts. (Reserved)