



ANSI ES1.4 - 2021
Event Safety – Event Fire Safety Requirements

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The ESTA Technical Standards Program was created to serve the ESTA membership and the entertainment industry in technical standards related matters. The goal of the Program is to take a leading role regarding technology within the entertainment industry by creating recommended practices and standards, monitoring standards issues around the world on behalf of our members, and improving communications and safety within the industry. ESTA works closely with the technical standards efforts of other organizations within our industry, including ESA, USITT and VPLT, as well as representing the interests of ESTA members to ANSI, ICC, UL, and the NFPA. The Technical Standards Program is accredited by the American National Standards Institute.

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The Event Safety Working Group, which authored this Standard, consists of a cross section of entertainment industry professionals representing a diversity of interests related to event production, insurance and legal matters, rigging and stage machinery for theatrical events. ESTA is committed to developing consensus-based standards and recommended practices in an open setting. Future Event Safety Working Group projects will include updating this publication as changes in technology and experience warrant, as well as developing new standards and recommended practices for the benefit of the entertainment industry.

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 INS = ; Insurance Company; PA = ; Performing Artist

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Foreword

The **Event Safety Guide** was first published by the Event Safety Alliance (“ESA”) in 2014 as a treatise which identified and explained various reasonable practices regarding the many aspects of special event safety. With permission from the UK Health and Safety Executive, ESA’s Guide was modeled after, and extensively borrowed from HSG195, The Event Safety Guide (Second edition), A guide to health, safety and welfare at music and similar events, often referred to as “The Purple Guide.”

In 2016, the Event Safety Working Group (ESWG) was established within ESTA’s Technical Standards Program in order to convert certain Event Safety Guide chapters into formally recognized, consensus- based standards that could be universally referenced across special events organizers, producers, enforcement agencies and user-groups. This document is one of those standards, intended to be used in conjunction with each other, which are used to identify reasonable care and safety at special events.

Because events constantly evolve, so too will this collection of standards.

It is assumed in this standard that the design and implementation of processes described here are entrusted to reasonably qualified and experienced people who are knowledgeable about the circumstances of their particular event.

This standard may serve as guidance to regulatory and other enforcement authorities. Compliance with this standard, however, does not itself satisfy legal obligations or confer immunity from legal consequences in any specific circumstance.

This document uses annex notes to provide additional reference information about certain specific section requirements, concepts, or intent. Subject matter with a corresponding annex note reference is identified by the asterisk (*) symbol, and the associated reference text is found in Appendix A, Commentary, identified with the referring text section number – e.g., an annex note to section 3.2 will be identified in Appendix A, Commentary as A.3.2. The annex notes are informational only, and do not add or subtract from the mandatory requirements of this standard.

Introduction

The principle goal of this standard is to identify and describe the steps necessary to establish a reasonable level of life safety and property protection from the hazards of fire, explosion and dangerous conditions at a live event. This includes looking at measures to avoid fire risks, effective response should an incident occur, planning escape routes and basic firefighting measures. Further details must be obtained from the local fire and building officials with jurisdiction over the venue.

In the first half of the twentieth century, structure fires caused the most carnage in crowded places. Notorious incidents included the 1942 Cocoanut Grove nightclub fire (492 dead), the 1944 Hartford circus tent fire (167 dead), and the Rhythm Club in 1940 (209 dead). In spite of advanced technology and an what should have been an improved understanding of the fire threat, nightclubs continue to be the scene of horrific fires and high casualty counts, including at the Yiyuan Disco in China (1994, 233 dead), the Ozone Disco in the Philippines (1996, 162 dead), the Station Nightclub in Rhode Island (2003, 100 dead), the República Cromañón in Argentina (2004, 194 dead), the Lame Horse Nightclub in Russia (2009, 156 dead), and the Kiss nightclub in Brazil (2013, 242 dead).

The threat of fire to life, equipment, and structures in most venues is reduced significantly when appropriate, comprehensive fire safety measures are taken. However, never underestimate how easily and quickly fire can threaten not only the venue but also everyone in and around it. Much existing fire code has come from the lessons learned over the past 200 years in around the world where seemingly insignificant situations quickly turned into epic tragedies. Fire should always be considered one of the most significant threats to an event and, thus, fire safety should always be treated as a priority and managed accordingly.

As with any standard that covers a broad subject, one should not get lost in the details of this Fire Safety standard. The number or names of factors to be considered is less important than the event organizer's thoroughness in identifying and considering their own reasonably foreseeable risks and developing risk mitigation plans to address them.

The root of a plan that is "reasonable" is that one has justification for one's actions – ideally good justification. Event organizers can most effectively assess and plan to mitigate fire safety risks when they work with all relevant stakeholders during the planning process, collectively assess the risks for that event at that time, and record the reasons for those decisions in a manner that will survive the event and help explain the decision-making process long after memories have faded and personnel have moved to new jobs. A reasonable plan must also be balanced; that is, it must be appropriate, achievable and not excessive.

There is no single "best" practice for fire safety. Once one meets the minimum legal requirements embodied in applicable statutes and regulations, there may be many reasonable ways to manage, prevent, mitigate and respond to fires. Those choices might be different for a different event, or the same event with different weather, or where the crowd is foreseeably more or less active or made up of differing age groups. Users of this standard should find that liberating and empowering. Event organizers must think through the circumstances of their event, take seriously open-ended questions such as "What could go wrong?" and threat-related questions like "Will there be cooking and catering at the event?" then either (a) accept the most reasonably foreseeable risks as is, or allocate resources to (b) eliminate them entirely, (c) mitigate them as much as possible, or (d) transfer them to someone else (e.g., through contractual requirements such as stipulations that require all materials be flame retardant or touring entertainers that require the evacuation plan be the responsibility of the venue). This thought process is part of what makes an event organizer's job so important.

1 General

1.1 Scope

This standard applies to fire safety in the live event industry. As used here, the live event industry includes concerts, festivals, sporting events, motorsports, community celebrations, theater and film production, corporate events and activations, trade shows, and similar events, both indoors and outdoors.

Fire safety is the identification and assessment of event specific fire risks, and the effects that fire and smoke will have to the life safety of all persons who may be affected. Fire Safety includes those measures required to

minimize the likelihood of a fire starting, means of escape (egress), fire safety monitoring, and the methods used to limit the development, spread, and effects of fire.

This standard does not address (a) requirements related to certifying fire fighters and their associated training; (b) requirements related to the construction of firefighting equipment; (c) requirements related to the construction, use, and maintenance of motorized fire fighting apparatus; (d) technical requirements of any equipment used for communications, illumination, signs or other hardware; and, (e) installation of fixed fire alarm and suppression systems.

1.2 Purpose

The purpose of this standard is to achieve a level of life safety, property protection, from actual and potential hazards created by fire, explosion, smoke, heat and other hazardous conditions at a live event.

1.3 Equivalency

The provisions of this standard are not intended to prevent the use of any materials or to prohibit any design or method of fabrication not specifically prescribed by this standard, provided that any such alternative materials, design or method of fabrication complies with the intent of the provisions of this standard. The quality, strength and effectiveness of all materials and methods of work shall be at least equivalent to those prescribed in this standard. This standard is not intended to replace or supersede any applicable local rules or laws but should supplement them in an abundance of caution with the ultimate goal of improving safety.

1.4 Application

This document is one part of a larger collection of standards relating to live event safety. The requirements of the complete collection shall be considered in relation to the application of this standard, where such consideration is necessary to coordinate and correlate all related requirements into a fire safety plan.

1.5 Normative references

The following documents contain requirements relating to the scope of this standard. They are provided for guidance only, unless otherwise referenced specifically elsewhere within this standard. Where a specific version is not given, the version applicable to the event jurisdiction shall be used.

International Fire Code, International Code Council
International Building Code, International Code Council
NFPA 101 Life Safety Code
NFPA 1 Fire Code
NFPA 551 Guide for the Evaluation of Fire Risk Assessments
OPSI, Information Policy Team. (2007). Fire Safety Risk Assessment: Open Air Events and Venues Department for Communities and Local Government
OPSI, Information Policy Team. (2006). Fire Safety Risk Assessment: Large Places of Assembly. Department for Communities and Local Government
OPSI, Information Policy Team (2006). Fire Safety Risk Assessment: Theatres, Cinemas and Similar Premises. Department for Communities and Local Government
The Regulatory Reform (Fire Safety) Order 2005 (UK)
Fire Safety Act (Scotland) 2005, as amended
The Fire Safety (Scotland) Regulations 2006
Work Health and Safety Regulation 2011 (Australia)
Managing the Work Environment and Facilities 2011 (Australia), Code of Practice, Section 5 Emergency Plans.
AS3745-2010 "Planning for emergencies in facilities" (Australia)
IEC/ISO 31000, *Risk management: Principles and Guidelines*
IEC/ISO 31010, *Risk management: Risk Assessment Techniques*
ANSI/ASSE/ISO Guide 73, *Vocabulary of Risk Management*
ANSI/ASSE/ISO (Technical Report) TR-31004, Risk Management – Guidance for the Implementation of ISO 31000
ANSI/ASSP Z10.0, Occupational Health and Safety Management Systems
ANSI/ASSP/ISO 45001, Occupational Health and Safety Management Systems – Requirements with Guidance for Use

OSHA 29 CFR 1910, General Industry
Event Safety Alliance, *Event Safety Guide*, 2014
The Fire Safety Regulations (Northern Ireland) 2012
UK Workplace (Health, Safety and Welfare) Regulations, 1992
German Building Code, *Muster-Versammlungsstättenverordnung MVStättV*.
BS 9999:2017, *Fire safety in the design, management and use of buildings*. Code of practice.

2 Definitions

† **2.1 Approved:** Acceptable to the AHJ.

2.2 Area of refuge: An area where persons unable to use stairways (usually in wheelchairs) can remain temporarily to await instructions or assistance during emergency evacuation.

2.3* Assembly occupancy: (Group A) A specific classification of building occupancy. It includes, among others, the use of a building or structure, or a portion thereof, for the gathering together of persons for purposes such as civic, social or religious functions; recreation, food or drink consumption; or awaiting transportation. See also *occupancy classification*. Assembly occupancies might include armories, assembly halls, auditoriums, churches, club rooms, dance halls, drinking establishments and exhibition halls among others.

2.4 Audience area: The planned, predetermined, and measurable space occupied by the audience during an event. This space may be inside or outside a structure.

† **2.5 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.

2.5.1 Authority Having Jurisdiction (AHJ) for fire safety: Identical to “fire code official” as defined in the International Fire Code (IFC)(2018), which is “The fire chief or other designated authority charged with the administration and enforcement of the code, or a duly authorized representative” (p. 27).

2.6 Automatic sprinkler system: For fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The system includes a suitable water supply and a network of specially sized or hydraulically designed piping installed in a structure or area, generally overhead, to which automatic sprinklers are connected in a systematic pattern. The system is usually activated by heat from a fire and discharges water over the fire area.

2.7 Back of house: The backstage and storage areas of the theatre.

† **2.8 Battery:** Two or more cells connected together electrically in series or parallel, or both, to provide the required operating voltage and current levels. A *lithium-ion battery* (aka, Li-ion battery) is one example that is an inherent fire risk.

2.9 Cellular plastic: See *foamed plastic*.

† **2.10 Change of use:** A change in the purpose or level of activity within a structure that involves change in application of the requirements of the Code.

† **2.11 Code:** A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

† **2.12 Combustion:** A chemical process of oxidation that occurs at a rate fast enough to produce heat and usually light in the form of either a glow or flame. Products of combustion may be highly toxic.

2.13 Competent person: One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous, and who has authorization to take prompt corrective measures to eliminate them (OSHA 29 CFR 1926.32(f)).

† **2.14* Construction documents:** Documents that consist of scaled design drawings and specifications for the purpose of construction of new facilities or modification to existing facilities.

2.15 Control: Measure that is modifying risk (ANSI/ASSE/ISO Guide 73 [Z690.1-2011], *Vocabulary for Risk management*, p. 12).

2.16* Emergency action plan (EAP): A collection of designated tasks, that may be communicated verbally or in writing, designed to facilitate and organize activities during an emergency.

2.17 Evacuation: To withdraw from an event space, whether inside or outside or both, in an organized way to a safe area in response to a situation that threatens the health or safety of patrons.

2.18* Event: Any assembly, public or private, indoor or outdoor, which is presented to a live or virtual audience. As used herein, this includes the planning for, preparation for and dismantling of (load in, load out) the event. See also *Live Event*.

2.19 Event space: The location or area in which a live event takes place. See also *live event* and *event*.

2.20 Event personnel: Anyone working or volunteering at the event, including vendors, contractors, subcontractors, laborers, volunteers, etc.

† **2.21 Exit:** That portion of a means of egress system that is separated from all other spaces of the building or structure by construction, location, or equipment as required to provide a protected way of travel to the exit discharge.

† **2.22 Exit access:** That portion of a means of egress that leads to an exit.

† **2.23* Exit discharge:** That portion of a means of egress between the termination of an exit and a public way.

2.24 Fire code: A mandatory fire regulation enforced by the AHJ.

2.25 Exit route: See *means of egress*.

2.26* Fire extinguisher: (a.k.a., flame extinguisher, extinguisher, or portable fire extinguisher) A fire protection device, typically a hand-held cylindrical pressure vessel containing an extinguishing agent, used to extinguish or control small fires.

† **2.27* Fire resistance:** The ability of a material, product, or assembly to withstand fire or give protection from it for a period of time.

† **2.28* Fire risk assessment (FRA):** A process to characterize the risk associated with fire that addresses the fire scenario or fire scenarios of concern, their probability, and their potential consequences.

2.29 Fire safety plan: a.k.a., “emergency action plan”. A formal, written document or collection of documents containing (a) policies addressing fire prevention and fire safety, and (b) the procedures to follow in case of a fire.

2.30 Fire watch: A temporary measure intended to ensure continuous and systematic surveillance of a building or portion thereof by one or more competent persons for the purposes of identifying and controlling fire hazards, detecting early signs of unwanted fire, raising an alarm of fire and notifying the fire department (IFC, 2015, p. 25).

† **2.31 Fire retardant:** A liquid, solid, or gas that tends to inhibit combustion when applied on, mixed in, or combined with combustible materials.

† **2.32 Flame effect:** The combustion of solids, liquids, or gases utilizing atmospheric oxygen to produce thermal, physical, visual, or audible phenomena before an audience.

† **2.33 Flame resistant** - The property of a material whereby combustion is prevented, terminated, or inhibited following application of a flaming or non-flaming source of ignition, with or without subsequent removal of the ignition source.

† **2.34 Flame retardant:** So constructed or treated that it will not support flame.

† **2.35 Foamed plastic:** (a.k.a., cellular foamed plastic) A heterogeneous system comprised of not less than two phases, one of which is a continuous, polymeric, organic material, and the second of which is deliberately introduced for the purpose of distributing gas in voids through the material.

† **2.36 Grandstand:** A structure that provides tiered or stepped seating.

† **2.37 Hazard Identification:** The process of identifying situations or conditions that have the potential to cause injury to people, damage to property, or damage to the environment.

† **2.38 Hot work:** Any activity that creates a source of ignition, including, but not limited to, welding, cutting, open flames, frictional heat or sparks, smoking, pyrotechnics, and operation of internal combustion engines.

† **2.39 Listed:** Equipment, materials, or services included in a list published by an organization that is acceptable to the AHJ 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.

† **2.40 Lithium-ion battery** (aka, Li-ion battery): A [rechargeable] storage battery that consists of lithium ions imbedded in a carbon graphite or nickel metal-oxide substrate. The electrolyte is a carbonate mixture or a gelled polymer. The lithium ions are the charge carriers of the battery. A lithium-ion battery is an inherent fire risk.

2.41 Live event: Any assembly, public or private, indoor or outdoor, which is presented before a live audience. As used herein, this includes the preparation for and dismantling (load in, load out) of the event. See also *Event*.

2.42 Magazine: A building or structure, other than an explosives manufacturing building, approved for the storage of explosive materials.

2.43 May: Denotes an action that this standard recommends that a user consider, depending on how reasonable it is under the circumstances of a given event.

† **2.44 Means of egress:** (a.k.a., means of egress system) A continuous and unobstructed way of travel from any point in a building or structure to a public way consisting of three separate and distinct parts: (1) the exit access, (2) the exit, and (3) the exit discharge. Some means of egress are only used in an emergency.

† **2.45 Means of escape:** A way out of a building or structure that does not conform to the strict definition of means of egress but does provide an alternative way out.

2.46 Membrane structure: Any spatial structure covered with, or comprised primarily of fabric or membrane, whether self-supported by air pressure or supported by a frame of any type, used to provide an environmental barrier over and/or around equipment and people. This term, as used herein, includes all tent, tensioned membrane, air-inflated, and/or air-supported structures.

2.47* Model code: Standard or collection of standards that may be adopted into administrative law or regulation that is (are) developed and maintained by a standards organization—such as the NFPA, the International Code Council, or ESTA—independent of the jurisdiction responsible for enacting the law or regulation.

2.48 Must: Denotes a mandatory requirement, which is used here only when referred to a standard, code, or other requirement that carries the force of law. See also *shall*.

- † **2.49 Noncombustible material:** A material that, in the form in which it is used and under the condition anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.
- † **2.50 Occupancy classification:** The system of defining the predominant operating characteristic of a portion of a building or plant for purposes of applying relevant sections of this code.
- † **2.51* Occupant load:** The total number of persons that might occupy a building or portion thereof at any one time.
- † **2.52 Panic hardware:** A door-latching assembly incorporating a device that releases the latch upon the application of a force in the direction of egress travel.
- † **2.53 Platform:** The raised area within a building used for the presentation of music, plays, or other entertainment.
- † **2.54* Public way:** A street, alley or other similar parcel of land essentially open to the outside air deeded, dedicated, or otherwise permanently appropriated to the public for public use and having a clear width and height of not less than 10 ft (3050 mm).
- † **2.55 Pyrotechnics:** Controlled exothermic chemical reactions that are timed to create the effects of heat, gas, sound, dispersion of aerosols, emission of visible electromagnetic radiation, or a combination of these effects to provide the maximum effect from the least volume. When used in this standard, “pyrotechnics” shall include “flame effects.”
- † **2.56 Qualified person:** A person who, by possession of a recognized degree, certificate or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project.
- † **2.57 Risk:** A measure of the probability and severity of adverse effects that result from exposure to a hazard.
- † **2.58 Risk assessment:** An overall process that identifies hazards, estimates the likelihood of occurrence of injury or damage to health, estimates the potential severity of injury or damage to health, and determines if protective measures are required.
- 2.59 Safety briefing:** a.k.a., “event safety meeting” and “site safety induction.” A meeting, typically brief, to ensure that team members are informed on safety issues related to the event (event safety briefing) or assignment (assignment safety briefing or “toolbox talk”).
- † **2.60* Safety data sheet (SDS):** Formatted information provided by chemical manufacturers and distributors of hazardous products about chemical composition, physical and chemical properties, health and safety hazards, emergency response, and waste disposal of the material. The SDS was formerly known as a “material safety data sheet” or MSDS, a term that may still be used in some parts of the world.
- 2.61 Shall:** Indicates a mandatory requirement. See also *must*.
- 2.62* Should:** Denotes a recommendation or that which is advised but not required.
- 2.63 Site safety induction:** See *safety briefing*.
- † **2.64 Situational or situation awareness:** The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future.
- 2.65 Stage:** An area, raised structure, or platform intended for use in a presentation or performance often used as a focal point for an audience or group of attendees. See also *platform*.

2.66 Standard: A required or agreed level of quality or attainment.

† **2.67 Structure:** An assembly of materials forming a construction for occupancy or use for a specific purpose.

2.68 Tent: See *membrane structure*.

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3 General Fire Safety

3.1 Every event shall be planned, designed, constructed, equipped, maintained and operated in accordance with this standard.

3.2* If any apply at the location of the event, compliance with all applicable fire safety related laws, regulations and codes is required.

3.2.1* If one or more applicable fire laws, regulations or codes do not exist or apply at the location of the event, compliance with the applicable elements of a model fire code acceptable to the AHJ is required.

3.2.2 This standard is intended to supplement or complement a model code, not replace it or conflict with it.

3.3 Where more than one applicable fire safety related laws, regulations or standards applies at the location of the event, the more restrictive shall be used.

3.4 If this standard conflicts with any fire safety related law or regulation applicable at the location of the event, the law or regulation shall prevail over this standard.

3.4.1 Every fire safety plan shall comply with this standard and (a) Chapter 4 of NFPA 101, *Life Safety Code* (2018), General Requirements, and (b) Chapter 13 of NFPA 101, *Life Safety Code* (2018), Existing Assembly Occupancies, or equivalents acceptable to the AHJ.

3.4.2 Any event not in compliance with this standard shall be required to take corrective action to come into compliance with this standard unless a specific exemption has been authorized by the AHJ.

3.4.2.1 The application of an exemption by the AHJ shall not violate applicable fire safety related laws, regulations, or codes.

3.5 Any person who deliberately or through negligence sets fire or causes the burning of any combustible materials during the any part of the event in such a manner as to endanger safety of any person or property shall be in violation of this standard.

3.6 All entities related to the event (e.g., owner, operator, subcontractor, occupant, worker) shall be responsible for complying with this standard and all applicable laws, regulations and codes.

3.7 All equipment, devices and materials shall be used in accordance with the manufacturers' instructions and limitations and, where required, display all necessary labels.

3.8 All necessary documentation for the event required by applicable laws, regulations and codes, this standard, and the AHJ shall be maintained onsite throughout the duration of the event.

3.9 The maximum occupant load shall be established in advance of the event and in compliance with all applicable laws, regulations and codes and with this standard.

3.9.1 Where no applicable building or fire codes exist, the method for determining the maximum occupancy load described in NFPA 1, the International Fire Code, or an equivalent standard acceptable to the AHJ, shall be used to establish a maximum occupant load.

3.10 Each event shall produce an emergency action plan that is provided to the AHJ for review and approval.

3.10.1 The emergency action plan should follow the guidance provided in Chapters 2 and 3 of the Event Safety Guide (ESA, 2014).

3.10.2 As a minimum, the emergency action plan shall include the following:

3.10.2.1 Procedures for reporting of emergencies

3.10.2.2 Response to emergencies

3.10.2.3 Evacuation procedures appropriate to the building/site, its occupants, emergencies, and hazards

3.10.2.4 Designated relocation and assembly areas

3.10.2.5 When elevators may be used

3.10.2.6 Conduct of fire drills or, when this is not possible, training and briefing of personnel in relevant fire safety procedures

3.10.2.7 Location and operation of event-related fire protection systems

3.10.2.8 Other items required by the AHJ

3.11 Open flames and ignition sources shall only be used if such use complies with this standard and is approved by the AHJ.

3.11.1 A fire risk assessment (FRA) of the specific open flame ignition source hazard shall be presented to the AHJ for approval.

3.12* Where the use of open flames or ignition sources is permitted, the flame or ignition source shall be continuously attended by a competent person.

3.12.1 During the use of such open flames or ignition sources the qualified person shall meet all three of the following requirements:

3.12.1.1 Not be given other tasks that would materially distract or compromise his or her role as an attendant, and

3.12.1.2 Have immediate access to, and be properly trained in the use of, fire extinguishing equipment that is adequate and appropriate for the expected fire hazard.

3.12.1.3 Have the immediate means to raise the alarm or otherwise communicate a hazard or fault.

3.13 To reduce the time it takes for emergency responders to identify, locate, and access the event during an emergency, all events should display signage that easily identifies the location of the event from the nearest public access road or road frontage.

3.13.1 All persons working at the event should be given information so they can accurately describe the location of the event, and their position within the site.

3.14 As a minimum, all performance platform (stage) edges, the leading and side edges of each stair tread on and behind the stage, and egress paths on and behind the stage, including back of house/backstage areas, shall be

clearly marked with visually contrasting material that is visible in reduced light conditions. Storage shall not be permitted within the marked egress path.

3.15* As a minimum, approved, portable fire extinguishers of the type specific to the fire hazard shall be provided and mounted as required by all applicable fire safety related laws, regulations and codes and otherwise should be provided in the following locations:

3.15.1 Portable power distribution locations, including near generators;

3.15.2 In temporary or portable dressing rooms;

3.15.3 Where scenery is stored;

3.15.4 Where narrow beam spotlights or lasers are in use;

3.15.5 Mobile concessions;

3.15.6 Where food is heated with electrical resistance heating or flame;

3.15.7 Where event-related ignition sources exist;

3.15.8 At intersections of catwalks (Steel structures over the stage and/or the audience area used by stage personnel to cross from one side to the other).

3.15.9 At all main entrances and exits

3.16* For events or performance areas with limited means of egress as a function of their design and use, the placement and availability of fire extinguisher should be considered. Examples of these types of spaces include followspot locations, venue attics and grids, loading floors, fly rails, trap rooms, and orchestra pits.

3.16.1 In locations where obstructions prevent visual identification of an extinguisher's location, including where occupants obstruct the view, signs or other means shall be provided at two meters above the floor to indicate the extinguisher location.

3.17 Safeguards designed to protect occupants during an emergency (e.g., sprinkler systems, alarm systems, fire doors, exit lighting) must be in proper working order at all times.

3.18* All ignition sources in the event space must be identified and removed or controlled using a fire risk assessment (see section 7).

3.19 The swings or all exit doors shall be in the direction of egress.

3.20 All sliding fence gates serving as exits shall remain in the open position during event hours or as approved by the AHJ.

3.21 At indoor event spaces, panic hardware is required on required exit doors serving 50 persons or more.

4 Occupant Load

4.1* Whether inside or outside a structure, a qualified person shall compute the occupancy load for a live event space, submit it to the AHJ for review and approval, and inform the event organizers of the result.

4.1.1 The qualified person shall provide the AHJ with accurate information in a timely manner to allow the AHJ to review and approve the occupancy load for a live event.

- 4.1.2** Event organizers may, and in the interest of patron safety often should, use an occupancy load that is less than the value computed by the AHJ.
- 4.1.3** In some circumstances, maximum allowable capacity of a space may be lower than the computed occupancy load due to aisle configurations, chair and table locations, and other objects in the space.
- 4.1.4** In every event space, the approved occupancy load must be posted in a conspicuous place near the entrance to the space.
- 4.2** Where a live event spaces is outside of a structure, the audience area shall be defined and included in the plan submitted to the AHJ for approval.
- 4.3*** If, at the event location, a method for computing occupancy load for an outside audience area that is confined by a fence, wall or similar egress-limiting element is not established in law, regulation, or code, occupancy load must be computed as follows:
- 4.3.1** For an audience area with fixed seating, occupancy load is established by counting the seats intended to be occupied by the audience.
- 4.3.1.1** No additional audience should be allowed to stand in aisles, egress paths or access gangways.
- 4.3.1.2** Where the audience area has fixed seating, the occupant load shall be reduced by a number that takes into account production elements that prevent a fixed seat from being occupied or if a production element reduces, restricts, impedes or alters any of the existing fire safety measures related to seating, egress, fire controls and alarms.
- 4.3.2** In an area without tables and chairs, or with temporary seating without tables, use a minimum 7 square feet (0.65 square meters) per person after subtracting area that will not be occupied by the audience (e.g., stage, closets and storage areas).
- 4.3.3*** Where the event space has temporary seating not at tables, the posted occupant load shall account for the size and type of seats used and be reduced by an amount that accounts for any production elements that prevent seats from being occupied safely.
- 4.3.4** In an area with tables and chairs, use a minimum 15 square feet (1.4 square meters) per person after subtracting area that will not be occupied by the audience (e.g., stage, closets and storage areas).
- 4.3.5** For benches without arms (e.g., bleachers), use a minimum 18 linear inches of seating length per person after subtracting area that will not be occupied by the audience (e.g., stage, closets and storage areas).
- 4.4** The approved occupant load for the event space shall not be exceeded.
- 4.5** All event spaces shall have a minimum of two exits unless there are no more than 50 occupants, the exit access travel distance is no more than 75 feet (22.9 m), the occupants are on the first story above or below grade plane, and one exit is approved by the AHJ.
- 4.5.1** For indoor and outdoor event spaces with more than 50 occupants, follow all fire safety related laws, regulations and codes to determine the proper number and location of exits.
- 4.6*** All open-air event spaces that are confined by fences, walls or similar egress-limiting elements, and involve a low fire risk, shall have an adequate number of exits and exit capacity to allow movement of occupants in less than ten minutes to a place of relative safety from which they can be transferred to a final exit. Where higher fire risks are present, this evacuation time shall be reduced correspondingly as fire risk increases.

4.7 Construction and event planning documents that include information describing occupancy classification, occupant load, number and capacity of exits, fire prevention procedures, fire protection features, and all details associated with emergency services shall be provided to the AHJ for approval.

4.8 Detailed, scaled plans should be submitted to, and approved by, the AHJ and event organizers for every live event.

5 Means of Egress

5.1* All exit routes must be maintained free and unobstructed.

5.1.1 Fall hazards in egress paths must be avoided; even one small step in the egress path of a large crowd can be hazardous.

5.2 Exit routes must remain visible in both day and night conditions and when the space is fully occupied, in both indoor and outdoor event spaces.

5.2.1 Any exit sign, marking or indicator should be identifiable at all points within both indoor and outdoor event spaces.

5.3 The maximum exit access travel distance from any part of a stage shall not exceed the lesser of either 30 meters (98 feet) or as required by any applicable code.

5.4 Aisles between the surrounding wall of the stage and any curtains or decorations must be no less than the larger of either 1.2 meters (3.9 feet or 47 inches) wide or as wide as required by any applicable code.

5.5 The width of the narrowest part of an egress path shall be determined by the applicable fire related laws, regulations or codes and the following, whichever is larger:

5.5.1 For outdoor, open-air event spaces: 1.2 meters (4.0 feet or 48 inches) per 600 occupants, and in no case less than 48 inches (1.2 meters).

5.5.2 For all other event spaces: 48 inches (1.2 meters) per 200 occupants and in no case less than 48 inches (1.2 meters).

5.5.3 Follow all fire safety related laws, regulations and codes to determine exit stair widths.

5.6 For a person seated at a continuous line of adjacent tables, the maximum travel distance to an aisle shall be 33 feet (10 meters).

5.7 Spacing between round tables shall be determined by any applicable fire safety related laws, regulations or codes and the following, whichever is larger:

5.7.1* Round tables shall be spaced so that the backs of occupied chairs are not less than 1 foot (.3 meter) apart (chair to chair) or 3.3 feet (1 meter) from a wall.

5.7.2 No round table shall be any closer to a wall than 55 inches (1.4 meters).

5.8 Exhibition areas shall be divided by aisles to ensure that the depth of exhibition stands does not exceed 98 feet (30 meters).

5.8.1 The distance from any part of an exhibition stand to the next aisle shall not exceed 66 feet (20 meters).

5.8.1.1 This distance is not added to the maximum exit access travel distance.

5.8.1.2 Aisles must be as straight as possible and lead towards separate exits.

5.8.2 In an exhibition area, the minimum aisle width, and width of the exit doors to which the aisle leads, shall be 10 feet (3 meters).

5.8.3 In addition to the requirements of other applicable laws, regulations or codes, temporary seating (rows of chairs) must meet the following requirements:

5.8.3.1 Chairs set up in a row shall be attached to each other so one cannot be easily removed from the row;

5.8.3.2 Chairs used for temporary seating must be at least 19.7 inches (50 cm) wide;

5.8.3.3* The distance between rows of chairs (cross aisles) must be at least 16 inches (40 cm);

5.8.3.4 Chairs in blocks shall have a maximum of 30 rows, an aisle of at least 48 inches (1.2 meters) must exist between such blocks, and these aisles must lead to exits by the shortest possible route;

5.8.3.5 In an indoor venue, a maximum of 10 chairs shall be placed to each side of an aisle, and a maximum of 20 chairs are permitted between two aisles;

5.8.3.6 In an outdoor venue, a maximum of 20 chairs shall be placed to each side of an aisle, and a maximum of 40 chairs are permitted between two aisles; and

5.8.3.7 Where only one aisle serves two blocks of chairs, one on each side, the aisle must be at least 78.7 inches (2 meters) wide and shall be increased proportionally for travel distance to the exit longer than 75 feet (23 meters).

6 Fire Safety on a Stage

6.1 Every stage must be constructed, designed, equipped, maintained and operated in accordance with this standard so as to provide a reasonable level of protection from actual and potential hazards created by fire, explosion, smoke, heat and other hazardous conditions.

6.1.1 Stage construction should be of inherently non-combustible or flame-retardant materials.

6.2 Props, curtains, drapes, decorative materials, wall coverings, and floor coverings located and used on a stage must be flame retardant and tested by and pass the requirements of NFPA 701, the IFC, or an equivalent standard acceptable to the AHJ.

6.3 In addition to the applicable laws, regulations, and codes, the following requirements shall apply to all stages, props, curtains, drapes, decorative materials, wall coverings, and floor coverings.

6.3.1 Props, curtains, drapes, decorative materials, wall coverings, and floor coverings located on a stage shall be permitted to be made from combustible materials only if the materials can accept the application of flame retardant treatments authorized by the manufacturer and approved by the AHJ. Alternate methods of these materials achieving flame retardant properties acceptable to the AHJ may be permitted.

6.3.1.1 All flame-retardant treatments that rely on a surface barrier method to resist ignition (such as paint with an approved fire-retardant additive) must be periodically inspected for damage.

6.3.1.2 In outdoor settings, any such treatment must be capable of withstanding foreseeable weather conditions for the duration of the event, or arrangements made for repeated applications.

6.3.2 When physical damage has occurred to props, curtains, drapes, decorative materials, wall coverings, or floor coverings located on a stage that rely on a surface barrier method to resist ignition (such as paint with an approved fire-retardant additive) thereby breaching the barrier effect of the method, such damage shall be rectified.

6.3.3 All of the following materials and locations with flame-retardant treatments, regardless of method, shall meet the applicable requirements of NFPA 101 (2018) 13.4.6.11, Flame-Retardant Requirements:

6.3.3.1 Combustible scenery of cloth, film, vegetation (dry), and similar materials;

6.3.3.2 Foamed plastics;

6.3.3.3 Scenery and stage properties not separated from the audience by proscenium openings protection; and

6.3.3.4 In theaters, motion picture theaters, and television stage settings, with or without horizontal projections, and in simulated caves and caverns of foamed plastic.

6.3.4.1 Event organizers must never make assumptions about the flammability characteristics of foam or soft goods used for decor. Any recycled or recovered materials should be assumed to be flammable and treated accordingly.

6.3.4 Any item failing inspection or testing shall be removed from service, completely replaced or receive additional approved treatment to the entirety of the material (not just the sample) until it meets the requirements of 6.3 of this standard.

6.3.5 Disposal of any flame-retardant treated or flame-resistant materials must be done in compliance with all applicable laws, regulations and codes.

6.3.6 Materials that readily ignite, are flammable, that drip flame when ignited or produce toxic fumes during combustion shall not be used on or under a stage.

6.3.7 No materials, props, curtains, drapes, or decoration shall be permitted such as to materially obstruct safe egress.

6.3.7.1 The use and position of any materials, curtains, drapes, and decoration on the stage shall be included in a fire safety plan.

6.3.8 All stages shall allow immediate access to fire extinguishing equipment appropriate for the material hazards and ignition sources present.

6.3.9 Location of such equipment shall be clearly located, sign posted and appropriately illuminated.

6.3.10 The stage personnel shall be trained in the use of any fire extinguishing equipment provided.

6.3.11 Where the use of flame effects have been approved and will be used (e.g., the use of open flame or pyrotechnics), dedicated fire extinguishing equipment shall be provided and dedicated, competent personnel shall be assigned for direct monitoring.

6.3.12 Exception: Section 6.3 shall not apply to fresh cut flowers or live plants used for decoration where such plants and flowers are placed in containers with water or a similar fluid, the fluid is regularly monitored and maintained, the flowers and plants are not allowed to dry out so as to present a combustion hazard, and the specific use and location of the flowers or plants are approved by the AHJ.

6.4 Where no other higher laws, regulations or codes exist, the minimum clearance from any heat producing equipment to any combustible material, curtains, drapes, or decorations shall be 3 feet 3 inches (1 m).

6.5 Where event personnel may temporarily occupy the space under a temporary stage, at least two exit paths must be clearly marked and illuminated for their use, and appropriate, accessible, approved fire extinguishing equipment shall be provided.

6.5.1 Where event personnel may temporarily occupy the space under a temporary stage, all such personnel shall be trained in the use of any applicable fire safety equipment and an exit drill shall be conducted prior to the first event.

6.6 At all times, smoking, storage of flammable and combustible liquids, and storage of easily ignited combustible materials shall be prohibited in the space beneath a temporary stage.

6.7 Any internal combustion engine-powered vehicle placed or used on a stage during a live event must meet all of the following requirements:

6.7.1 The stage must be engineered to support the static and dynamic loads placed on it by the weight and movement of the vehicle;

6.7.2 The wheels on the vehicle must be chocked and the vehicle must be secured from moving;

6.7.3 The fuel tank must be closed and sealed to prevent tampering;

6.7.4 The fuel tank shall not be more than one-third full or contain more than ten gallons (37.8 L) of fuel, whichever is less;

6.7.5 Fueling or defueling a vehicle is prohibited;

6.7.6 The battery used to start the engine shall be disconnected and at least one of the battery cables shall be taped or otherwise prevented from accidentally making contact with a battery terminal; and

6.7.7 The positioning and movement of the vehicle must not obstruct any egress path to or from the stage or the event space.

6.8 Any battery- or electric-powered vehicle placed or used on a stage during a live event must meet all of the following requirements:

6.8.1 The wheels on the vehicle must be chocked and the vehicle must be secured from moving;

6.8.2 The stage must be engineered to support the static and dynamic loads placed on it by the weight and movement of the vehicle;

6.8.3 Charging a vehicle's battery is prohibited;

6.8.4 The battery cells shall be disconnected and the main cable shall be taped or otherwise prevented from accidentally making contact with a battery terminal; and

6.8.5 The positioning and movement of the vehicle must not obstruct any egress path to or from the stage or the event space.

7 Fire Risk Assessment

7.1* A fire risk assessment (FRA) that meets the requirements of this section (7) shall be conducted at every event by a competent person.

7.1.1 The FRA should be documented.

7.1.2 The FRA shall identify all fire-related risks at the event.

7.1.3; Every risk identified in the FRA must be either mitigated or controlled.

7.1.4 Stakeholders should be identified and may include, but not necessarily be limited to, the following and should provide input into the FRA:

7.1.4.1 Regulators;

7.1.4.2 Facility owners and operators;

7.1.4.3 Employees and volunteers;

7.1.4.4 Emergency responders;

7.1.4.5 Insurers;

7.1.4.6 Neighbors;

7.1.4.7 Community;

7.1.4.8 Investors;

7.1.4.9 Design and construction team;

7.1.4.10 FRA preparers;

7.1.4.11 Tenants;

7.1.4.12 Crowd managers;

7.1.4.13 Production team;

7.1.4.14 Contractors; and

7.1.4.15 Vendors.

7.2 Although many methods and models for risk assessment are available, as a minimum, any method or model used must consider the following:

7.2.1 Whether a written summary document regarding the FRA should be made freely available to event personnel;

7.2.2 That the FRA be revised as necessary throughout the production process;

7.2.3 Assigning a number scale or risk matrix to the resultant risk rating;

7.2.4 Whether the resulting risk should be quantified in terms of impact and likelihood;

7.2.5 Who and what the risk may impact;

7.2.6* The steps taken to reduce the risks, likelihood, and impact (i.e., control measures); and

7.2.7 A physical examination of the event site or space and all event production elements to determine the risks present.

7.3* A method of conducting an FRA should be developed that can be applied uniformly from one situation to the next at a live event.

7.4* The FRA should evaluate all possible contributors to a fire scenario in terms of their likelihood, severity and consequences at the event.

7.5 The FRA should be evaluated using NFPA 551, *Evaluation of Fire Risk Assessments*, or equivalent standard acceptable to the AHJ.

7.6* Each FRA, as a minimum, should address the following:

7.6.1 Persons at risk—who is covered by this assessment;

7.6.2 Fuels/combustible materials present—what might catch fire;

7.6.3 Ignition sources—how might it catch fire (arson is likely at events);

7.6.4 Detection—how will anyone know if a fire has started;

7.6.5 Alarm—how will awareness of fire hazard be communicated internally within the organization and externally to first responders;

7.6.6 Means of escape—how will people get to safety from wherever they are in the venue, especially if other areas are occupied;

7.6.7 Fire fighting measures—both personnel and equipment; and

7.6.8 Resulting assessment of risk level and summary of key findings/monitoring/review points.

8 Fire Safety Plan

8.1* An approved fire safety plan that meets the requirements of this section (8) shall be prepared and maintained at every event by a competent person.

8.1.1 The training requirements of this standard shall not preclude training required by other applicable standards, codes, or laws.

8.1.2 Where this standard conflicts with any standards, codes, or laws applicable at the location of the event, the code or law shall prevail.

8.2* The fire safety plan shall include, as a minimum, the following elements, each of which must be approved by the AHJ:

8.2.1 Fire risk assessment (FRA) that meets the requirements of section 7 of this standard;

8.2.2 A list of fire hazards associated with the normal use and occupancy of the premises, including maintenance and housekeeping procedures.

8.2.3 An open flame and hot work policy describing where open flame is permitted and what additional mitigation measures may be required for any additional fire safety risk;

8.2.4 Applicable flame resistance certificates provided by qualified persons;

8.2.5 Safety data sheets (SDSs) for all hazardous materials, pyrotechnics, and flame-retardant treatments and products on the event site;

8.2.6 Fire safety documentation required by the AHJ;

- 8.2.7** A smoking policy that describes where smoking is permitted and what additional mitigation measures may be required for any additional fire safety risks;
- 8.2.8** Fire safety response and staffing plan;
- 8.2.9** Fire safety training documentation describing, as a minimum, the content of the training, who received the training, the time and date of the training, and the location of the training;
- 8.2.10** Fire safety venue/site plans including a map of the venue/site with fire safety related facilities, equipment, and locations noted;
- 8.2.11** Fire evacuation plan including provisions for the evacuation of those with special needs;
- 8.2.12** Emergency vehicle access plan including a map showing where and how such vehicles will gain access to all parts of the site, its buildings and its occupants and how this access will be monitored and maintained unobstructed during the event; and
- 8.3*** The elements of the fire safety plan shall be located in a well-known, easily accessible location such as the production office, which is made known to the AHJ prior to the event.
- 8.3.1** A responsible person on behalf of the event organizer shall ensure that relevant information on fire hazards (notably of high-risk materials or activities) are made known to the AHJ in advance of the event and made available on site as determined by the AHJ.
- 8.3.2** Maps showing risk locations, access routes and other resources (including contact details) should be prepared and circulated so that all relevant parties are briefed on the nature of fire hazards on site, such as the storage of compressed gases.
- 8.4** The fire safety plan for an event should be integrated into a broader event safety management plan such as that which is described in chapters 2 and 3 of the *Event Safety Guide*, 2014.
- 8.5*** All event personnel must receive a safety briefing that includes elements of the fire safety plan relevant to their assigned duties.
- 8.6*** As a minimum, event personnel shall be trained in the following regarding their role in the fire safety plan.
- 8.6.1** All elements of the fire safety plan commensurate with personnel's assigned duties;
- 8.6.2** The personnel's role and related training in fire prevention and protection activities, guest evacuations, and emergency procedures;
- 8.6.3** Location and use of any provided fire safety equipment;
- 8.6.4** Location and use of the fire alarm system, if one exists, and the procedure if no integrated system exists or is not operational;
- 8.6.5** Activation of the fire alarm system or, if no integrated system exists or is not operational, an alternate means of raising the alarm;
- 8.6.6** Means of alerting persons at immediate risk in the local environment;
- 8.6.7** Procedure for passing further information regarding the incident;
- 8.6.8** What to expect once the alarm has been activated;
- 8.6.9** Procedures for responding to a fire alarm;

8.6.10 Proper use of any equipment provided;

8.6.11 Egress routes and routes to assembly points;

8.6.12 Procedures for fire watch, should it be necessary;

8.6.13 Proper use of fire extinguishers; and

8.6.14 The role personnel play in fire prevention including being empowered to personally address developing hazardous conditions, preventing or removing egress path obstructions, and informing others of developing hazardous situations.

8.7* Event personnel must be able to verbally communicate their precise location within the event site to other personnel.

8.8 All events shall have as part of the fire safety plan a written fire evacuation plan, which shall include at least the following:

8.8.1 A summary of calculations and assumptions regarding egress that are required for established occupant load.

8.8.2 The preferred and any alternate means of notifying occupants of a fire or emergency;

8.8.3 The preferred and any alternate means of reporting fires and other emergencies to emergency response agencies;

8.8.4 Description of the emergency voice/alarm communication system alert tone and preprogrammed voice messages, where applicable;

8.8.5 Emergency egress and escape routes for the event site;

8.8.6 Procedures for event personnel during the evacuation including but not limited to operation of critical equipment during the evacuation;

8.8.7 Procedures for accounting for event personnel and occupants after evacuation has been completed;

8.8.8 Description of occupant and event worker assembly point(s);

8.8.9 Location of alarm stations and fire extinguishing equipment;

8.8.10 Identification and assignment of personnel responsible for rescue or emergency medical aid where applicable in the given circumstances;

8.8.11* Description of how various types of evacuations will be conducted, if approved; and

8.8.12 Identification and assignment of personnel to provide additional information and assistance for evacuated occupants.

8.9 All events should assign specific fire safety roles to event personnel as required in the given circumstances and such roles should include the following:

8.9.1 Briefing and training (training coordinator);

8.9.2 Evacuation plan operation and coordination;

8.9.3 Fire watch;

8.9.4 Appropriate use of fire extinguishing equipment;

8.9.5 Critical equipment operation;

8.9.6 Evacuation assistance;

8.9.7 Evacuation announcements and Information;

8.9.8 Accounting for evacuated occupants;

8.9.9 EMS communication and coordination;

8.9.10 Post evacuation information and assistance;

8.9.11 Assistance to those with special needs;

8.9.12 First aid and rescue; and

8.9.13 Communication monitoring and coordination

8.10 Written procedures shall be established for the assisted rescue, or movement to areas of refuge, for persons unable to use the general means of egress unassisted.

8.11 Fire safety venue/site plans shall include a pictorial or diagrammatic representation of the venue or event site with legible labeling, which identifies the locations of the following as a minimum:

8.11.1 Event equipment, stage, and seating;

8.11.2 Fire hydrants;

8.11.3 Alarm stations;

8.11.4 Fire extinguishing equipment;

8.11.5 Emergency Illumination;

8.11.6 Emergency vehicle access;

8.11.7 Occupant egress routes;

8.11.8 Areas of refuge; and

8.11.9 Fire exits.

9 The Authority Having Jurisdiction (AHJ) for Fire Safety

9.1* The AHJ for fire safety at a venue is a key component to the safety of attendees, personnel and the event's operation overall.

9.1.1 If no AHJ for fire safety exists or not enough notice has been given to engage the AHJ for fire safety, the event organizer must engage a qualified fire safety entity and delegate sufficient authority to this entity to carry out the role that otherwise would have been filled by the AHJ for fire safety.

9.1.2 Ensure applications for all required permits for pyrotechnics, building changes/alterations, and other fire and building code permits, are completed properly and submitted timely, as required.

9.1.3 Coordinate with the AHJ for fire safety well in advance of an event and ensure communications with appropriate public safety personnel during an event.

9.1.4 Identify, engage and meet the AHJ for fire safety early as possible in the planning of an event and inquire about the following:

9.1.4.1 All required documentation such as plans, drawings, permit applications, personnel training fire risk assessment, and any other required documents;

9.1.4.2 Any material samples that might be required to be provided such as curtains, tents, props, and similar items;

9.1.4.3 Any required meetings or site visits and their exact times and dates;

9.1.4.4 Any specialized fire safety equipment required;

9.1.4.5 Any requirements to be met for special effects that will be used; and

9.1.4.6 Any other requirements the AHJ for fire safety has for the event.

9.1.5 Invite the AHJ for fire safety to conduct a preliminary inspection of the event site far enough in advance of the opening of the event to allow ample opportunity to address any necessary improvements, and provide information to the AHJ regarding any high-risk areas or unusual activities which may affect fire safety or effective incident response.

9.1.5.1 If the AHJ for fire safety is not available for a preliminary inspection, event organizers must take it upon themselves to inspect, or use a qualified fire safety inspector, to evaluate their operations.

9.2* If the AHJ for fire safety makes a contested decision, an appeal to a higher authority may be possible.

10 Special Risks

10.1* Electrical. Ensure that applicable laws, codes, regulations, and standards are being met.

10.1.1 Water must not be used to extinguish a fire in energized electrical equipment.

10.1.2 Burning equipment must be deenergized prior to extinguishing, but a non-conducting extinguishing agent, such as carbon dioxide (CO₂) should still be used.

10.1.3 An electrical injury rescue plan (see ANSI ES1.17 for detail) must be developed and, where possible, include a specific method of deenergizing affected electrical subsystem(s) without deenergizing the entire electrical system.

10.1.3.1 Planning considerations must also include the risks associated with, and consequences of, total electrical system loss for the entire event.

10.1.4 Electrical equipment is a potential ignition source and must be treated as such, and consideration must be given to its proximity to all flammable and combustible materials.

10.2* Pyrotechnics. If pyrotechnics will be used, persons qualified and licensed, where required, for the effects being used must be involved to manage the storage, transportation, installation, removal, and use of any pyrotechnics at an event.

10.2.1* Ensure that applicable laws, codes, regulations, and standards are being met by persons qualified and licensed, where required, for the pyrotechnics being used.

10.2.2 Fire protection and life safety systems must not be disabled for the purposes of operating pyrotechnics or atmospheric effects (e.g., haze or theatrical fog) unless specifically approved by the AHJ, and fire risk must continue to be closely monitored.

10.2.3 A fire risk assessment must be conducted for any use of pyrotechnics at an event.

10.3* Tents. If tents, membrane structures, grandstands, or bleachers are involved, ensure that applicable laws, codes, regulations, and standards are being met.

10.4* Flammable and combustible liquids. Dangerous conditions related to the storage and use of such materials must be reduced and mitigated by compliance with flammable and combustible liquids laws, codes, regulations, and standards.

10.4.1 To permit the approach of fire control apparatus, there must be a 12 foot (3.6 meter) wide access way within 200 feet (61 meters) of any portable tank of flammable or combustible liquids stored outside a building.

10.5* Storage of compressed gases. The handling, storage, and use of compressed gases in cylinders and portable tanks must comply with applicable laws, codes, regulations, and standards.

10.6* Combustible dust. During work on (or the development of) stage effects, powder and dust are often created and used, which have the possibility of creating a combustible atmosphere.

10.6.1 Reduce dust and a potential fire hazard through compliance with laws, codes, regulations, and standards related to combustible dusts.

10.6.2* All powders and dusts, including those used for live event effects, must be considered combustible and used away from ignition sources.

10.7* Hazardous materials. Reduce risks of the use, storage, and handling of hazardous materials by compliance with laws, codes, regulations, and standards related to the use, storage and handling of hazardous materials.

10.8 Camping. When camping is included within the defined event site, it must be included in the event planning process, and procedures for evacuation of campsites must be included within the event emergency/evacuation plans.

10.8.1 Camping density should be considered in the FRA, and permitted camping density will depend on a number of factors such as:

10.8.1.1 The use of fire towers (elevated platforms used to monitor fire activity);

10.8.1.2 Number, width and positioning of fire lanes, which must be maintained so that fire extinguishing equipment can be delivered to extinguish a fire;

10.8.1.3 Regularity of campsite fire patrols;

10.8.1.4 Camper demographic; and

10.8.1.5 Availability of on-site fire-fighting provision, such as a mobile 4x4 fire-fighting unit able to carry large quantities of water.

10.8.2 Off-road fire-fighting vehicles may be required to access some parts of a site. The layout of any camping area and fire lanes needs to take into account the reach of the hose reels on the fire-fighting vehicles available for the event.

10.8.3 Where camping occurs, the FRA must consider hazards of campfires and providing the following should be considered:

10.8.3.1 Suitably trained event personnel;

10.8.3.2* As a minimum, locations at which supplies of water, buckets, sand, fire extinguishers and instructions telling the public what to do in the event of a fire should be provided;

10.8.3.3 Watchtowers consisting of raised platforms staffed by stewards with radios, which are a more effective means of observing for uncontrolled fires and suspicious behavior; and

10.8.3.4 Fire extinguishers and, depending on the scale of the event, an on-site capability to attend to fires with specialized vehicles.

10.8.4 Camping associated with an event can present fire-related hazards, many of which can be mitigated by the following:

10.8.4.1 Camping areas must be well defined to control boundaries and crowd density;

10.8.4.2* For a family-oriented campsite, a minimum of 226 square feet (21 square meters) per tent, with an average of two persons per tent, is adequate, and separation between tents is desired; but the area per tent should be increased proportionally if larger tents with greater numbers of occupants are used.

10.8.4.2.1 For general camping fields at rock/pop events, a minimum of 198 square feet (18.4 square meters) per tent should be used, with an average of two persons per tent;

10.8.4.3 Camping areas should be separated from parking, and roadways within camping areas should be well defined/marked;

10.8.4.4 To reduce car fires and vehicle versus pedestrian hazards, parking for vehicles, including live-in vehicles, should be separated from tent camping areas;

10.8.4.5 A site plan for campers should be provided;

10.8.4.6 Plans for severe weather and limited water supply should be provided; and

10.8.4.7 A means of warning occupants to evacuate area must be provided.

10.8.5 Communal or ceremonial fires (bon fires) should only be ignited by authorized and trained event personnel with adequate separation to guests, and proper fire watch or local fire service in attendance.

10.8.5.1 The specific use of communal or ceremonial fires (bon fires) must be approved by the AHJ and have adequate extinguishing equipment and water immediately available to control or extinguish the fire, if necessary.

10.8.6 Event personnel should be aware of the potential for drug labs within tents and hazards associated with them (i.e., fire, explosion).

10.8.7* Campfires should be discouraged, but if permitted, consider providing fire patrols and locations where fire extinguishing material, such as water, buckets, sand, and fire extinguishers are readily available.

10.8.8 Event personnel must be prepared to deal with small scale explosions of camping LPG cylinders, which are common causes of fires at campsites.

10.8.9 Event personnel must educate customers of the dangers of carbon monoxide from the use of cooking devices such as barbecues.

10.8.10. Where camping occurs, egress paths, aisles, and fire lanes must be maintained and a maximum of 100 feet (30.48 meters) should be maintained between aisles.

10.8.10.1 Egress paths and aisles must provide safe walking routes for pedestrians, free of trip hazards such as guy ropes and tent stakes.

10.8.10.2 Fire lanes must be wide enough to allow fire fighting equipment to pass unfettered. Where motorized fire vehicles will be used, these lanes should be at least 18 feet (5.5 meters) wide.

10.9* Commercial cooking. An FRA and safety checklist must be conducted when commercial cooking will take place at an event.

10.9.1 All commercial cooking installations at an event must have a written FRA and be approved by the AHJ.

10.10 Smoking. Smoking is a significant cause of fire ignition and must be controlled or prohibited at all indoor and outdoor events.

10.11* Lithium-ion (Li-ion) batteries. At all times, Li-ion batteries (a collection of electrical cells) must be used, handled, stored and transported according to manufacturer's instructions.

10.11.1 Any Li-ion batteries or cells showing signs of physical damage, discoloration, or deformity, must be immediately removed from use and disposed of safely in strict accordance with applicable laws or following the instructions of the manufacturer.

10.11.2 Steps must be taken to prevent the accidental shorting of battery terminals such as protecting them with covers that electrically isolate the terminals and prevent contact with other batteries.

10.11.3 Li-ion batteries must be stored separately from other batteries and protected against physical damage.

10.11.4 The location, quantity and charging method for Li-ion batteries must be evaluated as part of the FRA.

10.11.4.1* Banks of Li-ion batteries chargers that include more than five individual batteries must not be located near any emergency egress path.

10.11.5 Li-ion batteries must be stored out of direct sunlight, kept from close proximity to heat sources, and in a temperature range between 40 degrees F (4.4 C) and 80 degrees F (26.6 C).

10.11.6 Li-ion batteries must be stored and transported in containers properly labeled.

10.11.7 Vehicle operators and loading crew must be informed when Li-ion batteries are part of the cargo and its exact location within the cargo.

10.11.8 Vehicle operators and loading crew must be informed of the hazards associated with Li-ion batteries and how to monitor them for potential dangers.

10.11.9 Vehicle operators transporting Li-ion batteries must be trained in the procedures for handling a fire in cargo that includes Li-ion batteries.

10.11.10 Li-ion batteries must be transported in accordance with all applicable laws, codes, regulations, and standards.

Appendix A – Commentary

This appendix is not a part of the requirements of this standard and is included for informational purposes only. It contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.2.3 More specifically, the International Fire Code defines (IFC) an “A-4” assembly occupancy as including arenas and skating rinks, and an “A-5” assembly occupancy as including amusement park structures, bleachers, grandstands, and stadiums. A-5 assembly occupancies are the most likely to serve as entertainment venues.

In slight contrast to the IFC, the NFPA Glossary (2018) defines “assembly occupancy” as “an occupancy (1) used for a gathering of 50 or more persons for deliberation, worship, entertainment, eating, drinking, amusement, awaiting transportation, or similar uses; or (2) used as a special amusement building, regardless of occupant load” (p. 72). According to the NFPA, a “special amusement building” may be temporary, permanent, or mobile and contains a device or system that conveys passengers or provides a walkway along, around, or over a course in any direction as a form of amusement arranged so that the egress path is not readily apparent due to visual or audio distractions or an intentionally confounded egress path, or is not readily available due to the mode of conveyance through the building or structure (NFPA Glossary, 2019, p. 1807).

A.2.14 In slight contrast to the NFPA, the IFC (2018) defines construction documents as “the written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a permit” (p. 20).

A.2.16 In the U.S., some federal Occupational Safety and Health Agency (OSHA) standards require an employer to have an emergency action plan (EAP). These U.S. standards describe the minimum elements of an EAP to include the following as a minimum (OSHA 1920.138[c]):

- (1) Procedures for reporting a fire or other emergency;
- (2) Procedures for emergency evacuation, including type of evacuation and exit route assignments;
- (3) Procedures to be followed by employees who remain to operate critical plant operations before they evacuate;
- (4) Procedures to account for all employees after evacuation;
- (5) Procedures to be followed by employees performing rescue or medical duties; and
- (6) The name or job title of every employee who may be contacted by employees who need more information about the plan or an explanation of their duties under the plan.

U.S. OSHA standards also require that EAPs be reviewed with employees when the plan is developed or the employee is assigned initially to a job, when the employee's responsibilities under the plan change, and when the plan is changed. These are good minimum guidelines for all EAPs.

A.2.18 The “event” refers to the period of time that falls after the planning phase and pre-event activities and before all post-event activities.

A.2.23 In some parts of the world, “exit discharge” is equivalent to what is termed a “final exit.” This is also the point after which the event organizer is no longer responsible for applying the Code. People passing the exit discharge are deemed to have fully left the premises.

A.2.26 Typically, a fire extinguisher is not intended for use on an out-of-control fire, such as one which has reached the ceiling, endangers the user (i.e., no escape route, smoke, explosion hazard, etc.), or otherwise requires the expertise of a fire department or fire brigade. However, an extinguisher may also be helpful in keeping an exit usable or a similar situation that does not include fully extinguishing a fire.

A.2.27 In slight contrast, fire resistance is defined in the IFC (2018, p. 25) as “The property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases or flames under conditions of use.”

A.2.28 Other documents may refer to an FRA as fire risk analysis, fire hazard analysis, hazard analysis, or fire hazard analysis assessment.

A.2.47 Some examples of model codes include NFPA 1 (Fire Code), International Fire Code (IFC), and British Standard Institute European Norms (BSEN). British Standard 9999 BS 9999: *Code of practice for fire safety in the design, management and use of buildings*, is not adopted as a European Norm (EN). Similarly, there is Eurocode

which is not a British Standard (BS). BSEN is the designation of agreed code across the two jurisdictions. The departure of the UK from Europe (“Brexit”) will likely increase the differences between BS and EN standards.

A.2.51 The IFC (2018, p. 38) defines “occupant load” as “the number of persons for which the means of egress of a building or portion thereof is designed.”

In some parts of the world, occupant load is roughly equivalent to the term “occupant capacity,” which is defined as the maximum number of people who can be safely accommodated at the venue. Occupant load is determined by the building and/or fire code officials having jurisdiction who will take into consideration means of egress issues, aisles, fences, exiting from multiple levels, stairs, event-related obstacles (stages, delay towers, barriers, etc.), audience demographics (age, mobility, etc.), sightlines, and a number of other factors.

A.2.54 In some parts of the world, a public way is roughly equivalent to a “place of safety,” which is defined as a place in which a person is no longer in danger from fire.

A.2.60 A safety data sheet (SDS), formerly known as a material safety data sheet or MSDS, is a document intended to communicate the hazards of a chemical product in a uniform, 16-part format. An SDS includes information such as the properties of the chemical; the physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical.

A.2.63 If one determines that a recommended technique or activity is not going to be used for a particular event, this standard further recommends that the event organizer contemporaneously document the reason for that decision for future reference.

A.3 General Fire Safety

Understanding Fire: The Essential Components

A fire tetrahedron (pyramid) is a simple model for understanding the essential ingredients of a fire. The tetrahedron represents the three elements required to ignite and sustain a fire:

- Heat (ignition source)
- Fuel
- Oxidizing agent (usually oxygen in the air)
- Chemical chain reaction

A fire starts when an external ignition source in the form of a flame, spark, or hot ember heats fuel in the presence of oxygen. As the fuel and oxygen are heated, interaction between the fuel and oxygen increases causing a self-sustaining chemical chain reaction. Once ignition has occurred, removal of any one of the essential ingredients will extinguish the fire.

The essence of fire safety is ensuring that these essential ingredients do not combine in an undesirable way or at an undesirable time.

When applied to a fire, a number of substances can cool it below its ignition temperature and, thus, extinguish the fire. Although it does not extinguish all fires, water is the most common extinguishing agent due to its wide availability, inexpensiveness, and the great amount of heat absorbed as it turns to steam.

Without fuel, there is nothing to burn, thus removal of fuel extinguishes a fire. Wildland firefighters accomplish this by burning fuel in a managed and monitored way—a controlled burn. Certain chemical elements, such as aqueous film forming foam (AFFF), applied to the surface of ignited flammable liquid fuel serves to separate the fuel from the other essential ingredients of a fire.

Oxygen is found in adequate amounts in the earth’s atmosphere to support most combustion. If available oxygen is reduced during combustion, the combustion process slows. However, if enough heat and fuel remain, the fire may quickly and explosively reignite should air (with oxygen) be again introduced. Firefighters refer to this explosive re-ignition as “flashover.”

Oxygen can also be provided to the combustion process through oxidizing agents such as halogens (i.e., fluorine, chlorine, bromine, etc.) and nitrates, chlorates, and perchlorates, which are used in pyrotechnics.

Chemical chain reaction occurs when the three components come together and subsequently create an exothermic, chemical, chain reaction in the fuel, which results in combustion. This process--combustion--continues until at least one of the required ingredients are separated.

There are three stages to a fire: The incipient stage, smoldering stage, and flame stage.

The incipient stage is where preheating, distillation and slow pyrolysis take place ("Pyrolysis" is a process in which material is decomposed, or broken down, into simpler molecular compounds by the effects of heat alone; pyrolysis often precedes combustion). Gas and sub-micron sized particles are generated and carried away from the source by diffusion, air movement, and weak convection movement, produced by the buoyancy of the products of pyrolysis.

The smoldering stage begins with ignition and includes the initial stage of combustion. Glowing embers are visible, and invisible gases and smoke particles are generated and transported away from the source by moderate convection and background air movement.

The flaming stage is the time period between the initial occurrence of flame to a fully developed fire. At this stage, heat transfer from the fire occurs mostly from radiation and convection from the flame.

Classification of Fires

In firefighting, fires are identified according to one or more fire classes. Each class designates the fuel involved in the fire, and suggests the most appropriate extinguishing agent. The classifications allow selection of extinguishing agents along lines of effectiveness at putting the type of fire out, as well as avoiding unwanted side-effects. For example, nonconductive extinguishing agents are rated for electrical fires to avoid electrocuting the firefighter.

Using the incorrect type of extinguisher on a particular fire can actually make the fire worse.

A table of common classifications is below. Different countries vary in letters and symbols, so always check with a local authority for fire correct classifications and extinguishing agents.

U.S.	European	U.K.	Australian/Asian	Fuel/Heat Source
Class A	Class A	Class A	Class A	Ordinary combustibles
Class B	Class B	Class B	Class B	Flammable liquids
	Class C	Class C	Class C	Flammable gases
Class C	Unclassified	Unclassified	Class E	Energized electrical equipment
Class D	Class D	Class D	Class D	Combustible metals
Class K	Class F	Class F	Class F	Cooking oil or fat

Fire Classes

For easy reference, this section uses the most common letter classifications. Please note that other letters or symbols are possible in different international settings.

Normal Combustibles - Class A Fires.

In the majority of venues, Class A fires are the most likely type to occur. These fires consume ordinary combustibles such as wood, paper, plastics, fabric and rubber. Water, foam and dry chemical are effective agents for extinguishing this class. Water and foam are usually considered to be the most suitable agents.

The appropriate firefighting equipment would be hose reels, water-type extinguishers or extinguishers containing fluoroprotein foam (FP), aqueous film-forming foam (AFFF), or film-forming fluoroprotein foam (FFFP).

Flammable Liquids - Class B Fires.

These fires consume flammable liquids such as oil, paint, tars, solvents, or oil based products. Smothering effects which deplete the oxygen supply works best. Where there is a risk of fire involving flammable liquid, dry chemical or carbon dioxide fire extinguishers may offer the best result. However, foam (including FP, AFFF and FFFP) can be quite effective in dealing with a fire involving exposed surfaces of contained flammable liquid.

NOTE: A solid stream of water should never be used to extinguish a flammable liquid fire because it can cause the fuel to scatter, which could spread the fire.

Care should be taken when using carbon dioxide extinguishers as the fumes and products of combustion may displace oxygen and become hazardous in confined spaces.

Dry chemical (and dry powder) extinguishers can produce a vision obscuring cloud of “smoke” and can effect visibility and breathing if used in a crowd of people or in a confined space. Obscuring the vision of members of the audience can induce panic so these extinguishers should be used with care, especially when used in proximity to large crowds.

Flammable Gases - Class B (US) Class C (EU, UK, Australia).

This class contains flammable gasses such as butane and propane. They are dangerous to fight due to the risk of explosion, so should always be stored in a sealed container designed for the purpose.

Dry powder is considered one of the most effective agents in fighting this type of fire.

In the US this category is combined with Flammable Liquids and the same type of extinguisher would be used (one rated with a B)

Electrical - Class C(US)/E(Australia) Fires.

Electrical fires are fires involving energized electrical equipment, such as motors, controls, wiring, transformers or appliances. This sort of fire may be caused by short-circuiting machinery or overloaded electrical cables.

Electrical fires may be fought in the same way as an ordinary combustible fire, but water, foam, and other conductive agents are not to be used. While the fire is or possibly could be electrically energized, it can be fought with any extinguishing agent rated for electrical fire. Carbon dioxide (CO₂), FM-200 and dry chemical extinguishers such as PKP and even baking soda are well suited to extinguishing this sort of fire. Once the circuits involved are de-energized, it will generally become an ordinary combustible (class A) fire.

The U.S. system designates these “Class C;” the Australian system designates them “Class E.”

NOTE: These fires can be a severe hazard to anyone fighting the fire using water or other conductive agents: Electricity may be conducted from the fire, through water, the firefighter's body, and then earth. Electrical shocks have caused many firefighter deaths.

Combustible metals - Class D Fires.

Examples of flammable metals include sodium, titanium, magnesium, potassium, uranium, lithium, plutonium, and calcium. Magnesium and titanium fires are common. When one of these combustible metals ignites, it can easily and rapidly spread to surrounding ordinary combustible materials and pose a significant hazard.

Any flammable solid should be stored in the appropriate way to minimize fire risks. The International Fire Code, Chapter 59, offers one example of guidance on this topic.

Masses of combustible metals do not represent unusual fire risks because they are very difficult to ignite and have the ability to conduct heat away from hot spots so efficiently that the heat of combustion cannot be maintained. Metal fire risks exist when sawdust, machine shavings and other fine particles of metal are present. Generally, these fires can be ignited by the same types of ignition sources that would start other types of fire.

Water and other common firefighting materials used on metal fires can explode and make these fires worse because the high heat involved raises the temperature of the applied water to boiling so fast it does not have enough time to cool the fire. Carbon dioxide extinguishers are ineffective against certain metals such as titanium. Metal fires should be fought with “dry powder” extinguishing agents, or inert substances such as dry sand, that extinguish by separating the four parts of the fire tetrahedron.

Today a wide range of powder agents may be effective on class D fires including sodium chloride (Super-D, Met-L-X), copper based powder (Copper Powder Navy125S), graphite-based powder (G-Plus, G-1, Lith-X, Pyromet), and sodium carbonate based powder (Na-X).

Fires involving flammable or combustible metals are designated “Class D” in most countries.

NOTE: Metal fires represent a unique hazard because people are often not aware of the characteristics of these fires and are not properly prepared to fight them. Therefore, even a small metal fire can spread and become a larger fire in the surrounding ordinary combustible materials.

Cooking oils and fats - Class F (EU, UK, Australia)/ K (US) Fires.

Class K fires involve combustible cooking media such as oils, fats and grease commonly found in commercial kitchens. Though such fires are technically a subclass of the flammable liquid/gas class (B/C), the special characteristics of these types of fires, such as high temperatures, easy re-ignition, and likelihood of significant injury/property damage are considered important enough to recognize separately.

Certain cooking media formulations used in commercial food preparation require a special wet chemical extinguishing agent that is especially suited for extinguishing and suppressing these extremely hot fires that can re-flash. Saponification (a process that produces soap, usually from fats and lye) can be used to extinguish such fires. Fire extinguishers over commercial cooking surfaces may also have overhead hoods that help extinguish the fire.

Fires that involve cooking oils or fats are designated “Class K” under the American system, and “Class F” under the UK, European, and Australian systems.

Wet chemical fire extinguishers are tested and approved for Class F or K fires. They contain a potassium acetate based, low pH agent. This agent discharges as a fine mist, which helps prevent grease splash and fire re-flash while cooling the appliance. The Class F or K extinguisher (a.k.a., Purple K [PKP] or K-Guard) is a good choice for use on all cooking appliances including solid fuel char-broilers.

Portable Fire Extinguishers

Fire extinguishers do not replace fire suppression systems, which are present in many buildings.

Fire extinguishers are designed to fight different classes of fire. For example, in the U.S., an ABC extinguisher is capable of extinguishing class A, class B and class C fires. See the section above (*Classification of Fires*) for details regarding which type of extinguisher is best for each class of fire.

Each portable extinguisher also has a capacity, signifying how big an area could be treated by an ordinary user. The ratings are described using numbers preceding the class letter. As an example, consider an U.S. extinguisher rating of 1-A:10-B:C. The number preceding the A multiplied by 1.25 gives the equivalent extinguishing capability in gallons of water. In this example, the extinguisher with this rating (1-A) is equivalent to 1.25 gallons of water on a class A fire. The number preceding the B indicates the size of a class B fire in square feet that an ordinary user should be able to extinguish. In this example, the “10-B” indicates that a 10 square foot class B fire can be

extinguished by an ordinary user. There is no additional rating for class C (in this case referring to electrical), as it only indicates that the extinguishing agent will not conduct electricity. An extinguisher will never have a rating of just C (electrical). Capacity is rated in accordance with ANSI/UL 711, *Rating and Fire Testing of Fire Extinguishers*. This (U.S.) rating system is not always used in other parts of the world; other rating system standards exist in other regions. Users of fire extinguishers should be familiar with the rating system applicable to the location of the event.

In many countries, fire extinguishers, in all buildings other than residences, are generally required to be serviced and inspected by qualified personnel (e.g., a fire protection service company) periodically. Some jurisdictions or high-risk situations require more frequent service for fire extinguishers. Event organizers can easily check the service tags or labels on the extinguisher to confirm that it has been serviced in the past year, or other required period. If not, the extinguisher should be replaced or properly serviced.

Training is a very important component of fire extinguisher use. To prevent the indiscriminate use—and perhaps misuse—of a fire extinguisher, it is best if all personnel are trained in the proper selection and use of fire extinguishers. The information provided in this annex is not intended to replace such training. It is intended only to supplement proper training.

IMPORTANT: Fire extinguishers are not a substitute for trained firefighting professionals with state-of-the-art equipment. Fire extinguishers are, rather, a supplement to be used as a prevention measure that give people in the hazard area time to escape.

Do not fight a fire larger than you. If the fire is past its early (incipient) stages or if the use of more than one extinguisher is required, the safest recourse is to evacuate the hazard area, direct others to do the same, and call the fire brigade.

If the fire is determined to be small enough to fight with an extinguisher or if the extinguisher is needed to assist during an evacuation, trained persons can use the pneumonic PASS, which are the steps to use a portable extinguisher:

- P—Pull the safety pin
- A—Aim the nozzle at the base of the fire, from a safe distance (about 6 feet [2 m] away)
- S—Squeeze the handle
- S—Sweep the extinguisher from side to side while aiming at the base of the fire

Never let the fire get between you and the exit, and if you have to read the instructions on the fire extinguisher to operate it, do not use it. Instead, evacuate the hazard area, direct others to do the same, and call the fire brigade.

To be useful, portable extinguishers must be located in a conspicuous location where they will be readily accessible and immediately available for use. These locations must be along normal paths of travel, unless the fire authority having jurisdiction determines otherwise. In addition, portable fire extinguishers must not be obstructed or obscured from view and must be installed on manufacturer-provided or approved brackets securely anchored to the mounting surface. They need to be within close proximity of the involved space. Generally, the maximum travel distance to an extinguisher should be no more than 50 feet (15.24 m) and less when the risk is higher. Guidance on this can be found from the appropriate local authority having jurisdiction.

Appropriate types of portable fire extinguishers need to be chosen based on location and on the type of foreseeable fire risks. Most fire regulations suggest that extinguishers be properly installed in (at least) the following areas:

- In residential areas where people live and sleep;
- Where commercial cooking equipment is in use;
- In areas where flammable or combustible liquids are stored, used or dispersed;
- Fuel tank vehicles (for flammable or combustible liquids);
- In areas where quantities of any type of combustible materials are stored;
- Where flammable solids such as magnesium are stored, machined, grinded or otherwise processed, an appropriate Class D extinguisher or other extinguishing materials (scoop, shovel and bucket or extinguishing material);

- Where liquefied petroleum (LP) gases are stored or used;
- In structures under construction, at each stairway on all floor levels where combustible materials have accumulated, in every storage and construction shed, and where special hazards exist;
- In all tents and membrane structures;
- In vehicle repair and maintenance facilities;
- Special hazard areas, including areas such as laboratories, computer rooms and generator rooms; and
- Where required by the applicable building or fire codes.

Some extinguishers containing dry chemical extinguishing agents (for electrical or other class fires) may be confused with extinguishers containing dry powder extinguishing agents (for combustible metals). The two are not the same. Mistakenly using a dry chemical extinguisher (intended for an electrical fire) in place of a dry powder extinguisher (intended for a metal fire) can be ineffective and may increase the intensity of a metal fire. Always match the type of extinguisher with the class of fire anticipated.

Carbon dioxide (CO₂) is a clean gaseous extinguishing agent that displaces oxygen. CO₂ extinguishers are not intended for standard combustible fires as the high-pressure cloud of gas caused by the rapidly expanding frozen liquid stored in the pressurized vessel can scatter burning materials. CO₂ is also not suitable for use on fires containing their own oxygen source, such as metals. Although CO₂ may work well on a person's clothing on fire, such use should be avoided where possible as it can cause frostbite and, in an enclosed space, is dangerous because it displaces oxygen. CO₂ extinguishers will have the characteristic "horn" on the discharge end of the device, which makes a CO₂ extinguisher easy to identify.

A.3.2 Building codes and regulations place emphasis on public safety, and so are dependent upon how, and for what purpose, a space is used. Spaces used for storage are governed by requirements intended to protect the structure and its contents, while spaces specifically intended for public gatherings have additional requirements to ensure safety of human lives. Warehouses require large doors for equipment and truck access, and event centers have additional requirements governing the size of pathways to exits, and the size of exit openings to accommodate large numbers of people as they enter or exit the space. Storage facilities have different requirements than spaces used for public assemblies or gatherings. Many special events occur in spaces not specifically designed or intended for public gatherings. Empty warehouses are large, empty spaces that present opportunities for gatherings. However, such spaces are frequently deficient in basic safety requirements for public assemblies. The safety requirements for live events are more comprehensive, particularly when live events occur in spaces that were not specifically designed for such use. Because of this, the importance of understanding use classification cannot be overstated.

A.3.2.1 Example model codes include NFPA 1, *Fire Code*, and the *International Fire Code* (IFC).

A.3.12 "Continuously attended" does not have to require physical proximity. In some instances, such as a large stage with flame effects on exterior trusses, an attendant remaining in physical proximity to the ignition source is not possible. In such cases, any means by which a competent person would continuously monitor and supervise the ignition source will have to suffice.

A.3.15 The preferred fire extinguishing agent, and thus extinguisher, for a specific type of fire (i.e., simple combustible, liquid fuel fire, energized electrical equipment fire, metal fire, etc.) may be the most common extinguishing agent for a particular type of fire but may cause more damage, or other issues that require prematurely ending an event, rather than another extinguishing agent that might also be acceptable but would cause less damage. However, the amount of damage an extinguisher may cause should not impede proper use of any extinguisher.

Follow all applicable fire safety related laws, regulations and codes when mounting fire extinguishers. Do not place them on the floor or use them as door stops.

A.3.16 In such locations, extinguishers should be provided to both extinguish a fire in its incipient stage or to protect the egress path to enable people to reach safety.

A.3.18 Possible ignition sources at an event could include:

- Deliberate ignition due to arson
- Cooking and catering appliances, including barbecues (official catering and public campsites and picnic areas)
- Cigarettes, matches and lighters
- Campfires and bonfires
- Fixed and portable heating appliances
- Hot processes: welding, hot cutting, angle grinding, blacksmiths
- Faulty or misused electrical equipment
- Lighting equipment, light fixtures, general and effect/display lighting, lasers
- Open-flame candles, garden flares, open flame equipment
- Pyrotechnics, fireworks, flame effects
- Internal combustion engines
- Vehicle exhausts
- Lightning strike
- Fire used in performance, e.g. flame eater, fire juggler
- Equipment where ventilation has been blocked or compromised
- Build-up of dust in electrical equipment

A.4.1 A basic procedure used by the AHJ for determining the occupancy use for any live event begins with determining how the space is currently classified, and then comparing that to how it may be classified based on any change in use, or based on change in occupancy classification occurring because of the live event. Once the use classification is determined, then the occupancy limits can be established. Always remember, occupancy requirements can be influenced by use type, by square-footage area of use, and by number of occupants.

Occupancy calculations are based on fundamental criteria: use classification (usually “Assembly” in the context of a live event), size of the space, number of people, density of people, size and shape of exits, and presence of any (static or dynamic) obstructions that might impede or restrict the natural flow of people moving from one place to another.

Existing structures already have one or more use classifications established, and “Assembly” use is presumed in most event spaces. This is essential to establish if the needs of the event differ from the existing space’s ability to fulfill those needs. Premises may also have more than one use classification. For example, storage areas are likely classified differently than the space where patrons are entertained. This means that various areas of a venue may have different occupant loads related to the use classification of each.

Regardless of original Occupancy Classification, event organizers have a duty to ensure that there is sufficient egress, places of refuge, fire extinguishing and alarm equipment for the intended use of the space, having accounted for all design and production elements, equipment and number and of attendees.

Make sure there are arrangements for everyone to be able to escape safely from every structure and from the event site itself. These arrangements should be based on the findings of the fire risk assessment (FRA). Seek advice from a competent person who has sufficient expertise and experience in the type of event being planned.

The means of escape in case of fire should allow people, regardless of the location of the fire, to move safely along a recognizable escape route to a safe place (such as a street or open space) without being overcome by fire, heat or smoke.

Those in control of some structures with special features, such as fairground rides or inflatables, need to make special arrangements to ensure that people can escape if a fire breaks out.

For large crowds and in certain environments full evacuation may be inherently dangerous and disruptive, as such the options for partial evacuation, unmanaged evacuation (self-directed), phased evacuation, zoned evacuation, directed evacuation, invacuation (move to a safe location within the site/structure), horizontal or vertical evacuation, shelter in place, relocation, and lockdown need also to be assessed.

The *Purple Guide* in the UK (2019)—industry guidance, not a code or regulation—and several codes and regulations around the world, suggest that an escape route needs to lead to a place of safety; not just out of a tent or other event space. So, consider the kind of obstructions/incursions that commonly restrict the effectiveness of escape routes, which commonly include the presence of audience members external to the enclosed event space. They should not lead:

- to closed compounds (unless there is a ready means of opening the perimeter)
- past gas or other flammable stores
- through the kitchen or other likely source of the incident
- into campsites with no defined access route
- through an area that narrows to the point where it become dangerous

A.4.2.3 Some adaptations may have to be made to the method of computing a structure’s occupancy load to doing the same for an outside event site and audience area.

A.4.3.3 Aisle, stage, and chair setups affect occupancy load (allowable capacity) and egress requirements, which are described in section 5 of this standard.

A.4.6 Any variation from these times should be justified by means of a detailed fire risk assessment which quantifies movement rates, routes, and other hazards arising from the mass movement of a crowd.

According to the *Purple Guide* in the UK (*Event Safety Guide*, 2019) and the *Green Guide* in the UK (*Guide to Safety at Sports Grounds*, 6th Ed., 2018), calculating the number and size of exits required at an event site must take into consideration at least the following:

- Fire risk level (type of event, occupants, etc.)
- Escape time (how long is available to escape)
- Exit flow rate (how fast people will travel along the route)
- Occupancy (type of use and number of occupants; typically, “Assembly” occupancy in this context)
- Total exit width required (to enable all people to exit in required time)
- Minimum number and size of exits required

The capacity of an escape route is determined by the rate at which people pass along the route during each minute of the defined escape time. The following are suggested [maximum¹] rates of passage for open-air parts of event spaces (*Purple Guide*, 2019; *Green Guide*, 6th Ed., 2018):

- On all exit routes within seated accommodation (including gangways and ramps) and stairways 20 people per foot per minute (66 people per meter width per minute)
- On all exit routes in other parts of the event space (including within standing accommodation) 25 people per foot per minute (82 people per meter width per minute).

The *Green Guide* (2018, 6th Ed.) suggests that the width and capacity of the escape routes required for the number of people present can be calculated by using the formula:

$$; \text{Total exit width} = \frac{P}{F \times E}$$

Where:

P = number of people
 F = flow rate
 E = escape time

¹ A rate of passage, or flow rate, used for purposes of calculation should be considered as a maximum. In actual practice, such a figure is unlikely to be sustained for more than a short time, even under normal conditions.

Escape routes must lead to a place of safety and not just out of a specific event space such as a tent. The kind of obstructions and incursions that commonly restrict the effectiveness of escape routes must be taken into consideration, identified, and addressed. Escape routes must not lead...

- To closed compounds (unless there is a ready means of opening the perimeter)
- Past gas or other flammable storage
- Through a kitchen or other likely source of the threat
- Into campsites with no defined access route
- Through an area that narrows to the point where it become dangerous

A.5.1 Establishing a safe passageway for occupants of any space – indoor or outdoor – to move from areas of high risk to areas of low risk is essential to ensuring event safety. By definition, means of egress generally pertains to the function of all available pathways whereby occupants of a space – or attendees of an event – can access a public way. This function requires an assessment of several aspects of the event space: Size of space and definition of its boundaries, number of occupants, density of occupants, and – most important – the presence of reliable pathways of sufficient size and direction to permit the unobstructed flow of occupants from one place to another when necessary.

Not all pathways meet the requirements of a mean of egress (exit route). Exit routes must have certain characteristics such as being lit, signed, adequately sized, clear of obstructions, and other criteria established in the relevant fire code.

A.5.7.1 NFPA 101 (2018) and ICC IBC Section 1029 (2018) also describe table spacing and aisle widths when chairs and tables are used. Assuming 19 inches (0.48 meters) for the distance the chair is pulled away from the table edge, the total distance from table to table is 50 inches (1.27 meters).

A.5.8.3.3 NFPA 101 (2018), Section 13.2.5.5.1, allows a maximum of 22 inches between rows of chairs (cross aisles) when more than 14 seats are involved.

A.7.1 Comprehensive guidance on fire-safety risk assessment can be found in HM (UK) Government’s three fire safety risk assessment guides, one each for [Open air events and venues](#), for [Small and medium places of assembly](#), and for [Large places of assembly](#).

An FRA should be used to focus attention on what is important to fire safety. Qualifications of the one conducting the FRA should be documented and approved by the AHJ.

A.7.2.6; Any control measure(s) used should reduce the risk likelihood and impact to an acceptable level in the given circumstances.

A.7.3 Where applicable, if guidance within this standard is purposefully not followed (contradicted), justification for the decision should be documented.

A.7.4 As a minimum, the following topics should be considered when evaluating the likelihood and consequences of a fire scenario during an event:

Location & Date ; Weather ; Topography	Logistics ; Vehicles ; Heavy Equipment ; Fuel Storage
Audience size & Demographic ; Behavior ; Overcrowding ; Drugs & Alcohol ; Smoking Policy	Communication ; Communication Breakdown ; Limited Visibility ; Confusion ; Delayed Evacuation

<ul style="list-style-type: none"> ; Ability to escape ; Proportion of people with mobility aids, ; ; strollers, etc. ; Likelihood to follow directions ; Visual impairment 	<ul style="list-style-type: none"> ; Failing Sensors
<ul style="list-style-type: none"> Site/Venue ; Building(s) Age & Construction ; Capacity & Suitability ; Entry & Exit Requirements ; Alarm systems & Sensors ; Evacuation Routes ; Rally/Assembly points ; Special Considerations ; Wayfinding/signage 	<ul style="list-style-type: none"> Staffing ; Qualifications & Training Level ; Smoking Policy ; Assignments & Roles ; Work Hours ; Fire Watch ; Evacuee Verification
<ul style="list-style-type: none"> Food & Beverage ; Open Flame ; Ignition Sources ; Fuel 	<ul style="list-style-type: none"> Security ; Restricted Egress ; Prioritization Differences
<ul style="list-style-type: none"> Event Content ; Pyrotechnic 	<ul style="list-style-type: none"> Medical ; Oxygen storage
<ul style="list-style-type: none"> Design & Production ; Occupancy Load ; Required Egress ; Flammability & Treatment of Materials ; Evacuation Communication ; Fire Extinguishing Equipment ; Emergency Signs & Lighting ; Storage of materials & chemicals ; Catering & Promotions ; Open Flame Use ; Site Induction of personnel ; Backstage Egress ; Obstructions ; Ignition Sources 	<ul style="list-style-type: none"> Authority Having Jurisdiction (AHJ) ; Identify AHJ & Lead Agency ; Determine Applicable codes & Laws ; EMS Response times ; EMS response Capacity ; EMS Physical & Vehicular Access ; Documentation ; Inspection ; Emergency vehicle access to site
<ul style="list-style-type: none"> Sanitary Services ; Explosive Gases ; Chemical Spills 	<ul style="list-style-type: none"> Services for Guests with Special Needs ; Evacuation routes ; Evacuation duration ; Evacuation assistance ; Refuge areas
<ul style="list-style-type: none"> Crowd Management ; See ANSI BSR ES1.9 - 2020, <i>Crowd ; ; Management</i> 	<ul style="list-style-type: none"> Special Circumstances/Risks

A.7.6 There could be multiple FRA's for even relatively simple event sites.

A.8.1 The fire safety plan is effectively a summary of the actions identified in the FRA (see section 7).

A.8.2 For any event, the fire safety plan may require collaboration on the part the venue, the production, and any visiting show elements. Each element of the plan may be provided by different stakeholders.

A.8.3 The relevant elements of the fire safety plan may be distributed to event personnel commensurate with their assigned duties.

A.8.6 Training on the importance of the various roles one might play in the fire safety plan and the need for an individual to be attentive to their respective responsibilities are relevant topics on their own that should also be addressed.

Some general thoughts about safety training:

- There are at least two separate types of safety briefings: a general safety briefing for everyone on site (how to take care of themselves) and a briefing for those with a specific role in the fire safety plan.
 - Consider having those who have attended an event safety briefing sign that they have received such information.
- The general safety briefing should be similar to airline safety briefing and just as general.
- Some have shown a show safety briefing video during credentialing/accountability (personnel sign-in).
 - Consider showing a safety briefing video prior to credentialing.
 - Review the effectiveness of the video by asking questions of personnel after viewing. If the answers are incorrect, revise the video.
- Supervisors who have attended the safety briefing must, in turn, brief their subordinates.

A.8.7 The ability to describe with some accuracy one's location at an event (i.e., within a building, somewhere on a remote outdoor site, somewhere in a large complex, etc.) can make a significant difference in how long it takes assistance to reach the individual's location.

A.8.8.11 For large crowds and in certain environments full evacuation may be inherently dangerous and disruptive, as such the options for partial evacuation, unmanaged evacuation (self-directed), phased evacuation, zoned evacuation, directed evacuation, invacuation (move to a safe location within the site/structure), horizontal or vertical evacuation, shelter in place, relocation, and lockdown need also to be assessed.

A.9.1 "Fire Marshal" or "Fire Inspector" is the title often used to describe the individual who is responsible for ensuring that compliance is achieved with all applicable laws, codes, and standards related to fire safety. Building a positive relationship with the individual in this role, and demonstrating respect and courtesy toward him or her, is highly recommended.

The specific role of the fire marshal or inspector is likely dependent upon the location of the event. There is a misconception that all venues are inspected by a fire or other authority. However, this may not always be the case. Enforcement varies greatly around the world. It is up to the event organizer to make sure a qualified person is consulted to confirm compliance with all applicable laws, codes, and regulations related to fire safety. This must not be viewed as simply a compliance issue; it is a life safety issue that affects everyone at an event.

In some parts of the world, an "appointed person" is the individual responsible within an organization for implementing fire safety arrangements. A "steward" is a member of the event team whose work duty revolves around public safety, information and instruction should an incident occur.

A.9.2 This higher authority may vary based on jurisdiction, but typically resides with a chief fire officer, the state fire marshal in the United States, or the local or regional fire authority.

A.10.1 GFCI's will not protect against fire, only shock, but are nevertheless necessary to life safety. Circuit breakers must be used as these protect against cables or equipment overheating and igniting a fire.

Examples may include OSHA 29 CFR 1910 Subpart S – Electrical (in the U.S.A.); NFPA 70E, *Standard for Electrical Safety in the Workplace*; ANSI E1.19, *Recommended Practice for the Use of Class A Ground-Fault Circuit Interrupters (GFCIs) Intended for Personnel Protection in the Entertainment Industry*; and, ANSI ES1.17, *Electrical Installations and Lighting*.

A.10.2 Typical requirements for pyrotechnics at an entertainment event include:

- Only a properly trained and qualified individual should handle, store, install, remove, and use pyrotechnics. In some jurisdictions, this requires a license.
- Storage or holding areas for pyrotechnics should be limited to only one day supply, and continuously supervised by a person trained in relevant emergency response procedures.
- Storage of pyrotechnics should normally be within an approved magazine.

- Transportation of pyrotechnics should be done according to manufacturer's recommendations, and only within approved containers.
- Pyrotechnics should not be stored in proximity to an unprotected source of heat or flame. Specific distances from ignition sources is described in the various, applicable standards.
- A detailed plan for the use of pyrotechnics and flame effects in proximity to an audience must be in writing and provided to, and approved by, the AHJ.
- Fallout, wind and vegetation dryness should be taken into consideration in outdoor fireworks.
- A process for immediately halting the firing of pyrotechnics should be in place whenever pyrotechnics are used.
- People in proximity to staged or armed pyrotechnics is a hazard and should be avoided whenever possible.
- Rehearsals of pyrotechnic use should be conducted prior to live use and should involve the AHJ for fire safety and everyone who will be in proximity during use. Exact (safe) positions of individuals should be identified, noted, marked and rehearsed prior to the use of pyrotechnics.

See also Appendix B, *Example Checklist for Vetting Pyrotechnics Services Provider*.

A.10.2.1 Examples may include NFPA 160, *Standard for the Use of Flame Effects Before an Audience*; ICC Chapter 56, *Explosives and Fireworks*; NFPA 1 Chapter 65 (Provisions for the storage, use, and handling of explosives, fireworks, and model rocketry), NFPA 495, *Explosive Materials Code*; NFPA 1123, *Code for Fireworks Display*; NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles*; NFPA 1126, *Standard for the Use of Pyrotechnics Before a Proximate Audience*, and any local applicable laws, codes, and regulations.

A.10.3 Some examples of applicable standards include NFPA 102, *Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures*; ANSI ES1.19, *Safety Requirements for Special Event Structures*; and, ANSI E1.21, *Entertainment Technology: Temporary Structures Used for Technical Production of Outdoor Entertainment Events*.

Decorations, drapes, and hanging materials in tents should be treated for fire resistance to the same standard(s) as the tent material itself. If this is not possible, the decoration(s) should not be used.

Cooking and the use of stoves and fryers beneath or near a tent significantly increases the threat of a fire and thus requires compliance with additional fire safety requirements. Consider horizontal and vertical separation from any tent surface and, perhaps, the inclusion of a thermally insulating panel or protective surface.

When specific guidance or requirement are not available, the same egress requirements used in other structures should be used in tents.

A.10.4 Some examples of applicable standards include The International Fire Code (IFC), Chapter 57; NFPA 1 Chapter 66; and NFPA 30. These situations could include vehicles in and around a venue, generators, and other liquid fuel-powered equipment utilized during events.

Typical requirements for miscellaneous flammable or combustible liquids found at entertainment venues include the following (bulk storage and more than incidental use of flammable liquids is not contemplated here):

- Heat and ignition sources (smoking, hot work, open flames, sparks, etc.) should be eliminated as much as practical near storage, dispensing and use of flammable/combustible liquids.
- Fuel should not be stored near a generator.
- Storage (including temporary) and transportation of flammable and combustible liquids should be within normally closed, approved, listed cans/containers.
- Dispensing of flammable liquids should utilize proper bonding/grounding straps to prevent static electricity and possible vapor ignition and be conducted in a well-ventilated space.
- Electrical devices within 3 feet of dispensing area of flammable liquids must be Class I, Division 1 explosion proof rated.

- Provide for portable fire extinguisher(s); Class 10B minimum.
- No smoking signs should be posted near the storage and dispensing of all flammable liquids.
- Flammable and combustible liquids must not be stored near egress paths or beneath stairs.

A.10.5 Examples of applicable standards may include OSHA 29 CFR 1910.101 in the United States, The International Fire Code (IFC), Chapter 53; NFPA 1, Chapter 63; and NFPA 55.

Typical requirements for miscellaneous storage of compressed gases at an entertainment or event venue include:

- Compressed gas cylinders/tanks should be secured/stabilized against tip over (i.e., strapped to fixed object, or placed in milk crate in the case of typical LPG barbecue cylinders).
- Cylinders/tanks should be clearly marked with product name.
- Re-filling of containers should be performed outdoors in a safe location and only by specially trained personnel or gas supplier following manufacturer's instructions.
- All compressed gas cylinder/tank hoses should be protected against physical damage, such as falling objects, etc., including the use of guard posts or stanchions to guard against vehicular traffic damage.
- Compressed gas cylinders/tanks should be treated as full unless being handled by an authorized cylinder refiller or distributor.
- Pressure relief valves on all cylinders should be positioned to relieve pressure unobstructed to open air.
- Storage of flammable gas cylinders (e.g., propane) should be stored away from ignition sources and ordinary combustibles by a minimum of 10 feet (3 meters), and not within 25 feet (7.6 meters) of a building door/window opening.
- Bulk Storage of incompatible gases (such as oxygen and acetylene) should be separated by minimum of 20 feet (6.1 meters) or separated by non-combustible barrier having fire resistance rating of 1/2 hour.
- Cylinders or tanks should not be stored near elevators, unprotected edges of platforms, or other areas where such cylinders/tanks could fall in excess of 1/2 of tank/cylinders overall height.

Carbon Dioxide (CO₂) is likely the most used gas in live events and entertainment venues, but fuel (liquid petroleum or LP) gases such as propane and butane are commonly used for cooking and heating, liquid nitrogen may be used for ground fog, and welding (acetylene is not recommended on an event site; Oxy-propane is preferred), is also common. All of these are stored in cylinders under pressure, have additional hazards associated with each (e.g., oxidizers, flammable, combustible, oxygen displacing, etc.), and must be handled with extreme care.

A.10.6 Examples of applicable standards may include NFPA 1, The International Fire Code (IFC), NFPA 61, NFPA 652, and ANSI E1.40-2016, *Recommendations for the Planning of Theatrical Dust Effects*.

NFPA 1 Chapter 40 and IFC Chapter 22 deal with combustible dust and should be followed. Combustible dust is a hazard that is too often misunderstood in the live event industry.

Typical requirements for stage effects that create combustible dusts at an entertainment venue would include:

- Proper housekeeping should be performed, with dust accumulations greater than the thickness of a thin coin (in general) properly swept and disposed of. The use of compressed air to 'blow down' dust should be prohibited as this could create an increased explosion hazard.
- Stage effects using or creating airborne dust should be carefully engineered, designed and reviewed by qualified persons to determine potential combustible dust exposure and necessary precautions to take in respects to open flame/ignition sources, as well as health and safety of performers and personnel.

A.10.6.2 Combustible dust is defined as a solid material composed of distinct particles or pieces, regardless of size, shape, or chemical composition, which presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations. Combustible dusts are often either organic or metal dusts that are finely ground into very small particles, fibers, fines, chips, chunks, flakes, or a small mixture of these. Types of dusts include, but are not limited to: metal dust, such as aluminum and magnesium; wood dust; plastic or rubber dust; biosolids; coal dust; organic dust, such as flour, sugar, paper, soap, and dried blood; and dusts from certain textiles.

Five elements are necessary to initiate a dust explosion.

- Combustible dust (fuel);
- Ignition source (heat);
- Oxygen in air (oxidizer);
- Dispersion of dust particles in sufficient quantity and concentration; and,
- Confinement of the dust cloud.

If one of the above five elements is missing, an explosion cannot occur.

The ease of ignition and the severity of a combustible dust explosion are typically influenced by particle size. Other factors that influence the explosiveness of dusts include moisture content, ambient humidity, oxygen available for combustion, the shape of dust particles, and the concentration of dust in the air (OSHA, 2019).

A.10.7 Examples of applicable standards may include OSHA 29 CFR 1910.38 in the United States, The International Fire Code (IFC), Chapter 50; NFPA 1, Chapter 60 and Annexes B and D; NFPA 400; and NFPA 471.

The list of potentially hazardous materials is extensive and may include poisons, corrosives, and harmful chemicals in the form of cleaning products, artificial smoke, solvents, fuels, and other commonly used items. Events with notable quantities of these materials are rare and the risk is generally low. But wherever they exist, they must be handled carefully and safely.

A.10.8.3.2 Those who have been involved with many campsite fires and related incidents are usually of the opinion that these types of low-tech but localized interventions are far preferable to deployment of fire vehicles into campsites, especially where tent density is high. Most of the time, the fire truck arrives once the fire emergency is over and the process of bringing the vehicle to the scene created more hazards than it solved. Thus, the advice, when it comes to domestic tents in campsites, is to keep it local, quick and simple, and save the fire fighting vehicles for larger structures and high fire load areas. Fire apparatus should not be the first resource called or used in a campsite fire.

A.10.8.4.2 Two hundred twenty six (226) square feet (21 square meters) per tent is equivalent to a tent density of 442 tents per 100,000 square feet (2.3 acres, 9,290 square meters, 0.93 hectares), or 476 tents per hectare (2.47 acres, 107,639 square feet, 10,000 square meters).

One source in the UK (*The Purple Guide to Health Safety and Welfare at Music and Other Events*, 2019) suggests that...

...a density of 476 to 543 tents per hectare [226 to 198 square feet, or 21 to 18.4 square meters, per tent], with a predicted occupancy of 2 to 2.4 people per tent for general camping fields at rock/pop events is a realistic standard. In a more family-orientated campsite i.e. larger tents with greater number of occupants, this density would need to be reduced, possibly by as much as 50%. Land used within the campsite for access tracks, facilities, maintenance, entertainment, unusable space and storage should be factored into the planned size and subtracted from the space available for camping. Camping areas for people with disabilities should also be considered. These may require more space, using larger tents.

These density values reflect cultural behavior specific to the UK and may not translate directly to other parts of the world. Thus, caution is recommended in the use of this data. Consideration must be given to the quantity and quality of equipment brought to the site, how far vehicles are parked from the site, and similar issues that affect behavior.

A.10.8.7 Campfires constitute a risk of burns, tent fires (although most tent fires are caused by butane cannister mishandling) and can cause irritating smoke pollution. They are generally undesirable and should be discouraged. At some types of events, however, it would be impossible to prohibit fires and for certain audience profiles more regulated (communal) fires are likely to be an attractive option. Where fires are allowed, consider providing

chopped firewood to avoid destruction of trees and hedges and the potential for burning plastics and other material that could produce noxious fumes.

A.10.9 The commercial entity (vendor) is responsible for producing a fire risk assessment, including making provisions for fire risk avoidance, appropriate number and types of extinguishers, periodic inspection of gas installations, etc.

Commercial cooking at a live event presents unique hazards and, in general, should be controlled by:

- Cooking under tents/tarps is discouraged, especially for deep fat fryers.
- Tents or tarps, if used, should be flame retardant.
- Class K (wet chemical) extinguishers should be used on fryer fires and personnel should be trained in proper use.
- Class ABC (dry chemical) or Class A (pressurized water) can be used on other appliance/ordinary combustible fires.
- Propane (LGP) cylinders should be properly chained, cribbed or supported to eliminate tip-over.
- Refilling of propane cylinders shall be done only by authorized and trained persons.
- Perform vapor 'leak test' using soapy water after connecting regulator/hoses to cylinders.
- Propane hoses/cylinders shall be protected against physical damage and falling objects.
- Utilize only approved hoses and regulators; no modifications to hoses and regulators is permitted.

A.10.11.4.1 Large banks of chargers (more than five individual batteries) must be located away from egress paths and doors in occupied rooms to reduce the risk of the of a fire caused by a Lithium-Ion battery preventing a safe exit.

A.10.11.9 One example is IATA (International Air Transport Association) Guidelines.

Appendix B – Example Checklist for Vetting Pyrotechnics Services Provider

Ask the potential service provider the following questions and check off all affirmative answers. The more “yes” responses, the higher the score.

- Can they provide a safety plan that describes the procedures that will be followed for the event?
- Can they provide a specific, onsite safety contact person along with complete contact information?
- Can they describe minimum clearance distances from people?
- Do they have any weather criteria for the pyrotechnic operations to be conducted?
- Can they provide fire prevention and mitigation strategies for the pyrotechnic operations to be conducted?
- Can they include a description of their methods of ignition and how they might affect, or be affected by, production activities and technology?
- Can they provide a written description of actions that will be taken in the event of a misfire and how pyrotechnics will be made safe?
- Do they know which authorities they will be required to contact for any permit requirements?
- Can they provide the procedures that will be followed in the event the pyro area must be evacuated, and exactly how the area will be made safe?
- Can they describe the safe removal and disposal of remaining pyrotechnics once the event is concluded?
- Can they describe in writing the procedures for maintaining separation between the pyrotechnics and any people potentially in the area?
- Can they describe in detail the procedures for crew and performers who will be working in proximity to the pyrotechnics?
- Can they provide Safety Data Sheets (SDS) for all materials used?
- Can they describe in detail the hazards from radio frequencies and electrical systems created by the operational firing of the pyrotechnic system?
- Can they describe in detail the hazards created by production equipment and its proximity in operation to the pyrotechnics systems?