Extracts from the following standards to be updated at the second draft stage:

NFPA 59A, Production, Storage, and Handling of Liquefied Natural Gas (LNG), 2016 edition.
Committee Input No. 42-NFPA 1-2015 [ Section No. 2.3.3 ]

2.3.3 API Publications.
American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.


Submitter Information Verification

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Submittal Date: Thu Sep 24 09:15:58 EDT 2015

Committee Statement

Committee Statement: API publications to be updated at second draft stage.
Response Message:
2.3.6 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.


ASTM D 4359, Standard Test for Determining Whether a Material is a Liquid or a Solid, 1990 (reaffirmed 2012).


ASTM D 6823, Commercial Burner Fuels from Used Lube Oils, 2008.


ASTM E 2174, Standard Practice for On-Site Inspection of Installed Fire Stops, 2010a e1.


### Submitter Information Verification

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### Committee Statement

**Committee Statement:** ASTM references to be updated at second draft stage.

**Response Message:**
Committee Input No. 47-NFPA 1-2015 [ Section No. 2.3.9 ]

2.3.9 FM Publications.

FM Global, 1301 Atwood Avenue, P.O. Box 7500, Johnston, RI 02919.


Approval Standard for Plastic Plugs for Steel Drums, Class Number 6083, October 2006.


Submitter Information Verification

Submitter Full Name: Gregory Harrington
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Submittal Date: Thu Sep 24 09:45:58 EDT 2015

Committee Statement

Committee Statement: FM publications to be updated at second draft stage (NFPA 30 and NFPA 101 extracts).

Response Message:
2.3.11 IIAR Publications.
International Institute of Ammonia Refrigeration, 1001 N. Fairfax Street, Suite 503, Alexandria, VA 22314.

Submitter Information Verification
Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address: 
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Submittal Date: Mon Oct 19 19:56:20 EDT 2015

Committee Statement
Committee Statement: Referenced publication update. ANSI/IIAR 6 is anticipated to be complete prior to conclusion of the current NFPA 1 cycle.
Response Message:
Committee Input No. 50-NFPA 1-2015 [ Section No. 2.3.14 ]

2.3.14 NRFC Publications.
National Railroad Freight Committee, 222 South Riverside Plaza, Chicago, IL 60606-5945.
Uniform Freight Classification (UFC), 2005.

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Submittal Date: Thu Sep 24 09:54:10 EDT 2015

Committee Statement

Committee Statement: NRFC publication to be updated at second draft stage (NFPA 30 extract).
Response Message: C
Committee Input No. 53-NFPA 1-2015 [ Section No. 2.3.16 ]

2.3.16 STI Publications.
Steel Tank Institute, 570 Oakwood Road, Lake Zurich, IL 60047.

Submitter Information Verification
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Submittal Date: Thu Sep 24 10:03:04 EDT 2015

Committee Statement
Committee Statement: STI publication to be updated at second draft stage (NFPA 30 extract).
Response Message:
2.3.17 UL Publications.
Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.


UL 2245, Standard for Below-Grade Vaults for Flammable Liquid Storage Tanks, 2006.

Submitter Information Verification

Submitter Full Name: Gregory Harrington
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Street Address:
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Submittal Date: Thu Sep 24 10:06:21 EDT 2015

Committee Statement

Committee Statement: UL publications to be updated at second draft stage (numerous extracts).
Response Message:
Public Input No. 248-NFPA 1-2015 [Section No. 2.3.17]
Committee Input No. 55-NFPA 1-2015 [Section No. 2.3.18]

2.3.18 ULC Publications.
Underwriters' Laboratories of Canada, 7 Underwriters Road, Toronto, Ontario M1R 3B4, Canada.

Submitter Information Verification

Submitter Full Name: Gregory Harrington
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Street Address:
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Submittal Date: Thu Sep 24 10:09:49 EDT 2015

Committee Statement

Committee Statement: ULC publications to be updated at second draft stage (NFPA 10 extracts).
Response Message:

Public Input No. 218-NFPA 1-2015 [Section No. 2.3.18]
Committee Input No. 155-NFPA 1-2015 [Chapter 31 [Title Only]]

Forest Products and Biomass Feedstocks

Submitter Information Verification

Submitter Full Name: Gregory Harrington
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Street Address:
City:
State:
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Submittal Date: Tue Oct 20 14:06:50 EDT 2015

Committee Statement

Committee Statement:
The modification of the Chapter name is to provide for material covered by a new section to be added to the chapter dealing with biomass feedstock utilized at biomass to ethanol industrial facilities.

The revision is being moved as a committee input to solicit public comments and to allow further review at the second draft stage.

Response Message:
Public Input No. 238-NFPA 1-2015 [Chapter 31 [Title Only]]
Committee Input No. 156-NFPA 1-2015 [Section No. 31.1]

31.1 General.
The storage, manufacturing, and processing of timber, lumber, plywood, veneers, biomass feedstock, and by-products shall be in accordance with this chapter and NFPA 664, *Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities.*

Submitter Information Verification

Submitter Full Name: Gregory Harrington
Organization: National Fire Protection Assoc
Street Address:
City:
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Submittal Date: Tue Oct 20 14:08:23 EDT 2015

Committee Statement

Committee Statement: This submittal is part of a group of submittals to provide for requirements addressing the exterior storage of biomass feedstock utilized for biomass to ethanol manufacturing facilities.

The revision is being moved as a committee input to solicit public comments and to allow further review at the second draft stage.

Response Message:

Public Input No. 240-NFPA 1-2015 [Section No. 31.1]
31.3.10 Outside Storage of Biomass Feedstock

31.3.10.1 The fire hazard potential inherent in biomass feedstock storage operations with large quantities of combustible materials shall be controlled by a positive fire prevention program under the direct supervision of upper level management that shall include the following:

(1) Selection, design, and arrangement of storage yard areas and materials-handling equipment based upon proven fire prevention and protection principles

(2) Means for early fire detection, transmission of alarm, and fire extinguishment

(3) Establishment of control over the various factors that lead to spontaneous heating, including provisions for monitoring the internal condition of the pile

(4) Fire department access roads to separate large stacks and provide access for effective fire-fighting operations

(5) Separation of yard storage from yard buildings and other exposing properties

(6) Effective fire prevention maintenance program, including regular yard inspections by trained personnel

31.3.10.2 Bale stacks shall not exceed 25 feet (7620 mm) in height, 50 feet (15 240 mm) in width and 150 feet (45 720 mm) in length.

31.3.10.2.1 Bale stacks shall be in a maximum grouping of two bale stacks separated by 160 feet (48 770 mm) from each other with each group of two bale stacks separated from the next group of bale stacks by 400 feet (121 900 mm).

31.3.10.3 The storage site shall be reasonably level, on solid ground.

31.3.10.4 Access to the plant and yard from public highways shall be provided by all-weather roadways capable of supporting fire department apparatus.

31.3.10.5 All sides of each storage site shall be accessible by means of fire department access roads.

31.3.10.6 A fire department access road width of \( \frac{1}{2} \) times the bale stack height but not less than 20 ft (6 m) shall be provided, with fire department access roads between each set of two bale stack groupings.

31.3.10.7 Fire department access roads for access across each end, with a clear space of not less than 100 ft (30 m) to adjacent bale stack rows or other exposed property, shall be provided.

31.3.10.8 Power-operated, shovel-type or scoop-type vehicles, dozers, bale movers or similar equipment shall be available for use in moving stored material for fire fighting.

31.3.10.9 Training of the plant emergency organization also shall include procedures and precautions to be observed by yard crews employing power equipment in fighting internal fires.

31.3.10.10 Portable fire extinguishers for Class A fires shall be provided in accordance with Section 13.6 on all vehicles operating in the storage yard in addition to the normal Class B units for the vehicle.

31.3.10.11 Lightning protection shall be provided for the outside storage yard in accordance with NFPA 780

31.3.10.12 Outside storage yards shall be secured against unauthorized access in an approved manner.

31.3.10.13 Water supplies shall be provided in accordance with this Code.
stage.
Response
Message:

Public Input No. 241-NFPA 1-2015 [New Section after 31.3]
31.3.1.1
The requirements of this chapter shall apply to the outside storage of the following:
(1) Lumber and wood panel products at retail and wholesale lumber storage yards
(2) Lumber and wood panel products at other than retail and wholesale storage yards
(3) Ties, poles, piles, posts, and other similar forest products at pressure-treating plant yards
(4) Outside storage of wood chips, hogged material, and wood by-products
(5) Logs
(6) Outside storage of biomass feedstocks

Submitter Information Verification
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Submittal Date: Tue Oct 20 14:09:42 EDT 2015

Committee Statement
Committee Statement: The purpose of this submittal is to add storage requirements for biomass feedstock that is utilized for the manufacturing of ethanol. The stocks could include bales of corn stover, switch grass and/or hay. The general requirements for the storage of agricultural products are not appropriate for this activity.

The revision is being moved as a committee input to solicit public comments and to allow further review at the second draft stage.

Response Message: 

Public Input No. 239-NFPA 1-2015 [Section No. 31.3.1.1]
Chapter 45 shall not apply to buildings completely protected by an approved automatic fire-extinguishing system; however, this exclusion does not preclude the need for good housekeeping.

Chapter 45 shall not apply to biomass feedstock regulated by Chapter 31.

Submitter Information Verification

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Submittal Date: Wed Oct 21 12:53:21 EDT 2015

Committee Statement

Committee Statement: This is part of a group of proposals suggesting language in Chapter 31 for the safe storage of biomass feedstock utilized in the manufacture of ethanol. The general requirements for the storage of agricultural products does not appropriately address the safety of biomass outside storage at biomass to ethanol facilities.

Response Message: 

Public Input No. 245-NFPA 1-2015 [Section No. 45.1.2]
Committee Input No. 152-NFPA 1-2015 [ Chapter 46 ]

Chapter 46 - Reserved
   Reserved
   Marijuana Growing, Processing or Extraction Facilities
   See attached.

Supplemental Information

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Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address:
City:
State:
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Submittal Date: Mon Oct 19 20:32:29 EDT 2015

Committee Statement

Committee Statement: Marijuana growing, processing, or extraction facilities present unique hazards and safety concerns that should be addressed in NFPA 1. Currently, there is no guidance in the Code specific to these types of facilities. The new chapter is being proposed as a Committee Input as is not complete at this time. The committee is requesting additional feedback and comments for the public. In addition, a task group has been established to further review and develop the requirements and will present its work during the Second Draft meeting.
Chapter 46
Marijuana Growing, Processing or Extraction Facilities

46.1 — General
46.1.1 The growing, processing or extraction of marijuana within buildings shall comply with the requirements of chapter 46.
46.1.2 Chapter 46 shall not apply to the retail sales of marijuana.

46.2 — Application
46.2.1 Chapter 46 shall apply to the following:
   1. The commercial scale growing and processing of marijuana within a building.
   2. The use of fumigants within buildings used for commercial scale growing operations.
   3. The commercial scale extraction processing of oils and fats by the use of flammable or combustible liquids, flammable gases, liquefied petroleum gases or nonflammable gases, hereinafter referred to as “solvents.” The extraction process includes the act of extraction of the oils and fats by use of a solvent, desolventizing of the raw material and production of the miscella, distillation of the solvent from the miscella and solvent recovery. The use, storage, transfilling, and handling of hazardous materials in these facilities shall comply with this chapter, other applicable provisions of this code.
46.2.2 Chapter 46 shall not apply to extraction processes that use liquids that are miscible with water.

46.3 Multiple Hazards. Where a material, its use or the process it is associated with poses multiple hazards, all hazards shall be addressed in accordance with Section 5001.1 and other material specific chapters.

46.4 Existing building or facilities. Existing buildings or facilities used for the growing or processing of marijuana shall comply with this chapter.

46.5 Permits. Permits shall be required as set forth in Section 1.12

46.4 — DEFINITIONS (Possible replicated in Chapter 3)
46.4.1 Marijuana extraction facility (MEF): A building used for the solvent-based extraction process of marijuana.
46.4.2 Marijuana extraction equipment (MEE): Equipment or appliances used for the extraction of botanical material such as essential oils, from marijuana.
46.4.3 Marijuana extraction room (MER): The room or space in which the solvent-based extractions occur.
46.4.4 Finding: The results of an inspection, examination, analysis or review.
46.4.5 Observation: A practice or condition not technically noncompliant with other regulations or requirements, but could lead to noncompliance if left unaddressed.
46.4.6 Desolventizing: The act of removing a solvent from a material.
46.4.7 Miscella: A mixture, in any proportion, of the extracted oil or fat and the extracting solvent.
46.4.8 Transfilling: The process of taking a gas source, either compressed or in liquid form (usually in bulk containers), and transferring it into a different container (usually a smaller compressed cylinder).

46.5 GROWING OR PRODUCTION OF MARIJUANA
46.5.1 Controlled egress or access. Egress doors, whether access-controlled or electromagnetically locked egress doors shall comply with the respective section of Chapter 14.
46.5.2 Ventilation for light fixtures. Light fixture ductwork shall be installed in accordance with manufacturer and NFPA 90A.
46.5.3 Odor control. The use of ozone generators used for odor control shall be in accordance with Chapter 54.
46.5.4 Interior Finish. The use of any plastic including mylar or panda sheeting to enclose rooms or cover any walls or ceilings must be installed in accordance with the building code and this code. If plastic materials are used, the material shall comply with the building code and Section 12.5 of this code. The hanging of plastic from ceiling or from suspended overhead structures to create wall dividers is not allowed.

46.5.5 Fumigation. Any marijuana growing, processing, extraction or retail facility that is fumigated shall comply with this section. Fumigation for marijuana growing, processing, extraction or retail facilities includes the production or use of sulfur dioxide.

46.5.5.1 Sources of ignition. Fires, open flames and similar sources of ignition shall be eliminated from the space under fumigation or insecticidal fogging. Heating, where needed, shall be of an approved type.

46.5.5.1.1 Electricity. Electricity in any part of the building, structure or space where operation of switches or electrical devices, equipment or systems could serve as a source of ignition shall be shut off.

46.5.5.1.2 Electronic devices. Electronic devices, including portable equipment and cellular phones, shall be shut off. Telephone lines shall be disconnected from telephones.

46.5.5.1.3 Duration. Sources of ignition shall be shut off during the fumigation activity and remain shut off until the ventilation required in Section 2603.6 is completed.

46.5.5.2 Notification. The AHJ and fire department shall be notified in writing not less than 48 hours before the building, structure or space is to be closed in connection with the utilization of any toxic or flammable fumigant. Notification shall give the location of the enclosed space to be fumigated or fogged, the occupancy, the fumigants or insecticides to be utilized, the person or persons responsible for the operation, and the date and time at which the operation will begin.

Written notice of any fumigation or insecticidal fogging operation shall be given to all affected occupants of the building, structure or space in which such operations are to be conducted with sufficient advance notice to allow the occupants to evacuate the building, structure or space. Such notice shall inform the occupants as to the purposes, anticipated duration and hazards associated with the fumigation or insecticidal fogging operation.

46.5.5.2.1 Usage warning signs. Where fumigants and thermal insecticidal fogging products are used, approved warning signs bearing the “skull and crossbones” emblem with the warning “DANGER! POISON GAS! KEEP OUT!” shall be posted. Such signage shall be posted at all doors and entrances to the premises including interior rooms and areas, and along the exterior wall of the building or tenant space being fumigated at not less than 25 foot intervals. Such signage shall not be less than 7 inches in width and not less than 10 inches in height.

46.5.5.2.2 Warning signs. Approved warning signs indicating the danger, type of chemical involved and necessary precautions shall be posted on all doors and entrances to the premises, including interior rooms and areas.

46.5.5.2.3 Description and duration of posting. Signage shall be located at the exterior main entry and at the entries to those areas being fumigated indicating the duration of the fumigation. Signage shall indicate the following information, written in English as the primary language, red lettering on a white background, and with the lettering height as described:

1. The date and time of the operation in lettering not less than 2 inches in height.
2. Type of chemical involved in lettering of not less than 1 inch.
3. Necessary precautions for the chemical used.
4. The name and address of the person responsible for the fumigation in lettering of not less than 1 inch in height.
5. A warning stating the occupied premises shall be vacated at least one (1) hour prior to beginning of operation and shall not be reentered until danger signs have been removed by the responsible party, in lettering of not less than 2 inches in height.

46.5.5.3 Breathing apparatus. Persons engaged in the business of fumigation or insecticidal fogging shall maintain and have available approved protective breathing apparatus.

46.5.5.4 Watch personnel. During the period fumigation is in progress a responsible watchperson shall remain on duty at the entrance or entrances to the enclosed fumigated space until after the fumigation is completed and the building, structure or space is properly ventilated and safe for occupancy. Sufficient watchers shall be provided to prevent persons from entering the enclosed space under fumigation without being observed.

46.5.5.5 Evacuation during fumigation. Occupants of the building, structure or space to be fumigated, except the personnel conducting the fumigation, shall be evacuated from such building, structure or space prior to commencing fumigation operations.

46.5.5.6 Sealing of building structures, and spaces. Paper and other similar materials that do not meet the flame propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701 shall not be used to wrap or cover a building, structure or space in excess of that required for the sealing of cracks, casements and similar openings.

46.5.5.6.1 Maintenance of openings. All openings to the building, structure or space to be fumigated or fogged shall be kept securely closed during such operation.

46.5.5.7 Venting and cleanup. At the end of the exposure period, fumigators shall safely and properly ventilate the premises and contents; properly dispose of fumigant containers, residues, debris and other materials used for such fumigation; and clear obstructions from gas-fired appliance vents.

46.5.6 Use of carbon dioxide for growing operations. Growing operations utilizing carbon dioxide shall comply with Section 46.8.

46.6 PROCESSING OR EXTRACTION OF MARIJUANA

46.6.1 Location. Marijuana processing shall be located in a building complying with the building code and this code. The marijuana extraction process shall be located in a room dedicated to the extraction process. The extraction room shall not be used for any other purpose including storage.

46.6.2 Staffing. The extraction process shall be continuously staffed by personnel trained in the extraction process, the transfer of LP-gas where applicable, and all emergency procedures. All staff training records shall be maintained on-site by the owner and made available upon request from the AHJ.

46.6.3 Systems, equipment and processes. Systems, equipment, and processes shall be in accordance with Sections 46.6.3.1 through 46.6.3.7.1

46.6.3.1 Application. Systems, equipment and processes shall include, but are not limited to vessels, chambers, containers, cylinders, tanks, piping, tubing, valves, fittings, and pumps.

46.6.3.2 General requirements. In addition to the requirements in Section 46.8 systems, equipment and processes shall also comply with Section 60.5.1.6, other applicable provisions of this code, the building code, and the NFPA 90A.

46.6.3.3 Additional requirements for marijuana extraction. In addition to the requirements of Section 46.6.3, marijuana extraction systems, equipment and process shall comply with this section.
46.6.3.3.1 General requirements. The requirements set forth in Section 60.5.1.6 shall apply to vessels, chambers, containers, cylinders, tanks, piping, tubing, valves, fittings, and pumps used in the extraction process. The use of ovens in post-process purification or winterization shall comply with Section 46.8.3.3.7.

46.6.3.3.2 Systems and equipment. Systems or equipment used for the extraction of marijuana/cannabis oils and products from plant material shall be performed using equipment that has been listed for the specific use. If the system used for extraction of marijuana/cannabis oils and products from plant material is not listed, then system shall have a designer of record. If the designer of record is not a licensed Professional Engineer, then the system shall be peer reviewed by a licensed Professional Engineer. In reviewing the system, the licensed Professional Engineer shall review and consider any information provided by the system’s designer or manufacturer. For systems and equipment not listed for the specific use, a technical report documenting the design or peer review as outlined in 46.6.3.3.4.2 shall be prepared and submitted to the fire code official for review and approval for systems and equipment used for the extraction of marijuana/cannabis oils and products from plant material. The firm or individual performing the engineering analysis for the technical report shall be approved by the fire code official prior to performing the analysis.

46.6.3.3.3 Change of extraction medium. Where the medium of extraction or solvent is changed from the material indicated in the technical report or as required by the manufacturer, the technical report shall be revised at the cost of the facility owner, submitted for review and approval by the AHJ prior to the use of the equipment with the new medium or solvent. If the original Engineer of Record is not available, then new Engineer of Record shall comply with Section 46.6.3.3.4.1.

46.6.3.3.4 Required technical report. The technical report documenting the design or peer review shall be submitted for review and approval by the AHJ prior to the equipment being located or installed at the facility.

46.6.3.3.4.1 Approval of the Engineer of Record. Where a technical report is required to be submitted for review and approval by the AHJ to meet the requirements of 46.6.3.3.2, the following items shall occur:

1. Prior to submittal of the technical report, the engineer shall submit educational background and professional experience specific to the review and approval of system, equipment and processes with like hazards of those associated with the marijuana extraction system to the AHJ.

2. Once the proof of qualifications are found acceptable by the AHJ, the Engineer of Record shall produce the technical report and the report shall be signed and sealed in accordance with respective State requirements.

46.6.3.3.4.2 Content of technical report and engineering analysis. All, but not limited to, the items listed below shall be included in the technical report.

1. Manufacturer information.
2. Engineer of Record information
3. Date of review and report revision history.
4. Signature page shall include:
   a. Author of the report
   b. Date of report
   c. Seal, date and signature of engineer of record performing the design or peer review.
   d. Date and signature of the engineer performing the engineering check of the report. The engineering check cannot be performed by the authoring engineer.
5. Model number of the item evaluated. If the equipment is provided with a serial number, the serial number shall be included for verification at time of site inspection.

6. Methodology of the design or peer review process used to determine minimum safety requirements. Methodology shall consider the basis of design, and shall include a code analysis and code path to demonstrate the reason as to why specific code or standards are applicable or not.

7. Equipment description. A list of every component and subassembly (clamp, fittings, hose, quick disconnects, gauges, site glass, gaskets, valves, pumps, vessels, containers, switches, etc.) of the system or equipment, indicating the manufacturer, model number, material, and solvent compatibility. Vendor cut sheets shall be provided.

8. A general flow schematic or general process flow diagram (PFD) of the process. Post-processing or winterization may be included in this diagram. All primary components of the process equipment shall be identified and match the aforementioned list. Operating temperatures, pressures, and solvent state of matter shall be identified in each primary step or component. A piping and instrumentation diagram (PID or PI&D) may be provided but is not required.

9. Analysis of the vessel(s) if pressurized beyond standard atmospheric pressure. Analysis shall include purchased and fabricated components.

10. Structural analysis for the frame system supporting the equipment.

11. Process safety analysis of the extraction system, from the introduction of raw product to the end of the extraction process.

12. Comprehensive process hazard analysis considering failure modes and points of failure throughout the process. This portion of the review should include review of emergency procedure information provided by the manufacturer of the equipment or process and not that of the facility, building or room.

13. Review of the assembly instructions, operational and maintenance manuals provided by the manufacturer.

14. Report shall include findings and observations of the analysis.

15. List of references used in the analysis.

46.6.3.3.5 Building analysis. If the technical report, or manufacturers literature indicate specific requirements for the location, room, space or building, where the extraction process is to occur, the Engineer of Record, as approved in 46.6.3.3.4.1 shall review the construction documents of such location, room, space or building and provide a report of their findings and observations to the AHJ.

Analysis shall include:

1. Process safety analysis of the entire process from raw material to finished product.

2. Comprehensive process hazard analysis considering failure modes and points throughout the process. Should include review of emergency procedures as related to the equipment or process, and the facility.

46.6.3.3.6 Site Inspection. Prior to operation of the extraction equipment, if required by the AHJ, the Engineer of Record, as approved 46.6.3.3.4.1 shall inspect the site of the extraction process once equipment has been installed for compliance with the technical report and the building analysis. The Engineer of Record shall provide a report of findings and observations of the site inspection to the AHJ prior to the approval of the extraction process. The field inspection report authored by Engineer of Record shall include the serial number of the equipment used in the process and shall confirm the equipment installed is the same model and type of equipment identified in the technical report.
46.6.3.3.7 Post-process purification and winterization. Post-processing and winterization involving the heating or pressurizing of the miscella to other than normal pressure or temperature shall be approved and performed in an appliance listed for such use. Domestic or commercial cooking appliances shall not be used. The use of industrial ovens shall comply with Chapter 51.

46.6.3.3.7.1 An automatic fire extinguishing system shall not be required for batch-type Class A ovens having less than 3.0 cubic feet of work space.

46.7 Construction requirements

46.7.1 Location. Marijuana extraction shall not be located in any building containing a Group A, E or I occupancy.

46.7.1.1 Extraction room. The extraction equipment and process shall be located in a room dedicated to extraction.

46.7.2 Egress. Each marijuana extraction room shall be provided with at least one exit, swinging in the direction of travel provided with an automatic closer and panic hardware.

46.7.2.1 Facility egress. The marijuana extraction room shall not enter directly into an exit, exit passageway, horizontal exit or along the sole egress path from another portion of the building.

46.7.3 Ventilation. Each marijuana extraction room shall be provided with a dedicated hazardous exhaust system complying with Section NFPA 90A for all solvents other than water. The operation of the hazardous exhaust system shall be continuous.

46.7.4 Control area. Each marijuana extraction room shall be considered a single control area and comply with Section 60.4.2.

46.7.5 Ignition source control. Extraction equipment and processes using a hydrocarbon-based liquid or gas solvent shall be provided with ventilation rates for the room to maintain the concentration of flammable constituents in air below 25% of the lower flammability limit of the respective solvent. If not provided with the required ventilation rate, then Class I Division II electrical requirements shall apply to the entire room.

46.7.6 Interlocks. All electrical components within the extraction room shall be interlocked with the hazardous exhaust system and when provided, the gas detection system. When the hazardous exhaust system is not operational, then light switches and electrical outlets shall be disabled. Activation of the gas detection system shall disable all light switches and electrical outlets.

46.7.7 Emergency power

46.7.7.1 Emergency power for extraction process. Where power is required for the operation of the extraction process, an automatic emergency power source shall be provided. The emergency power source shall have sufficient capacity to allow safe shutdown of the extraction process plus an additional 2 hours of capacity beyond the shutdown process.

46.7.7.2 Emergency power for other than extraction process. An automatic emergency power system shall be provided for the following items when installed.

46.7.7.2.1 Required electrical systems.

1. Extraction room lighting
2. Extraction room ventilation system
3. Solvent gas detection system
4. Emergency alarm systems
5. Automatic fire extinguishing systems.

46.7.8 Continuous gas detection system. For extraction processes utilizing gaseous hydrocarbon-based solvents a continuous gas detection system shall be provided. The gas detection threshold shall be no greater than 25% of the LEL/LFL limit of the materials.
46.7.9 Liquefied-petroleum gases shall not be released to the atmosphere.

46.8 Carbon dioxide enrichment or extraction. Extraction processes or growing operations using carbon dioxide shall comply with the section.

46.8.1 Scope. Carbon dioxide systems with more than 100 pounds of carbon dioxide shall comply with Sections 46.8.1 through 46.8.1.8. This section is applicable to carbon dioxide systems utilizing compressed gas systems, liquefied-gas system, dry ice, or on-site carbon dioxide generation. Carbon dioxide systems shall not produce a concentration level of greater than 5,000 ppm in the room or area of use.

46.8.1.1 Permits. Permits shall be required as set forth in Section 1.12.

46.8.1.2 Equipment. The storage, use, and handling of liquid carbon dioxide shall be in accordance with Chapter 63 and the applicable requirements of NFPA 55, Chapter 13. Insulated liquid carbon dioxide system shall have pressure relief devices in accordance with NFPA 55.

46.8.1.3 Carbon dioxide generation: Appliances used for generation of carbon dioxide shall comply with the NFPA 90A as a non-vented fuel-fired appliance.

46.8.1.4 Protection from damage. Carbon dioxide systems shall be installed so the storage tanks, cylinders, piping and fittings are protected from damage by occupants or equipment during normal facility operations.

46.8.1.4.1 Required protection. Where carbon dioxide storage tanks, cylinders, piping and equipment are located indoors, rooms or areas containing carbon dioxide storage tanks, cylinders, piping and fittings and other areas where a leak of carbon dioxide can collect shall be provided with either ventilation in accordance with Section 46.8.1.7 and an emergency alarm system in accordance with Section 46.8.1.8.

46.8.1.5 Carbon dioxide systems. Equipment, meters or gauges, shall be provided in each area where carbon dioxide is used or stored to indicate the level of carbon dioxide. The meters or gauges shall be calibrated and inter-connected to the gas supply solenoids located at the storage container or generator to limit a maximum level of carbon dioxide to not more than 5,000 ppm in the room or area of use.

46.8.1.5.1 Carbon dioxide system valving. The carbon dioxide system shall be provided with valves, located at the point of storage or generation, and that positively close in the event of loss of power, or in the event of an alarm activation. The valves shall be manually reset.

46.8.1.5.2 Carbon dioxide system piping. The piping system used to distribute the carbon dioxide within the building shall be of an approved type. Piping shall be labeled in accordance with Chapter 63. All shutoff valving of the piping system shall be labeled as such.

46.8.1.5.3 Pressure relief systems. Pressure relief devices shall be vented to the exterior of the building.

46.8.1.6 Signage. At the entrance to each area using or storing carbon dioxide, signage shall be posted indicating the hazard. Sign shall be durable and permanent in nature and not less than 7 inches wide by 10 inches tall. Sign shall bear the “skull and crossbones” emblem with the warning “DANGER! POTENTIAL OXYGEN DEFICIENT ATMOSPHERE.” NFPA 704 signage shall be provided at the building main entry and the rooms where the carbon dioxide is used and stored.

46.8.1.7 Ventilation. Mechanical ventilation shall be in accordance with NFPA 90A and shall comply with all of the following:

1. Mechanical ventilation in the room or area shall be at a rate of not less than 1 cubic foot per minute per square foot.
2. Exhaust shall be taken from a point within 12 inches of the floor.
3. The ventilation system shall be designed to operate at a negative pressure in relation to the surrounding area.

46.8.1.8 Emergency alarm system. A carbon dioxide detection system shall be provided in each area where carbon dioxide is used and or stored. The emergency alarm system shall comply with all of the following:
   1. Continuous gas detection shall be provided to monitor areas where carbon dioxide can accumulate.
   2. The threshold for activation of an alarm shall not exceed 5,000 parts per million.
   3. Activation of the emergency alarm system shall initiate a local alarm within the room or area in which the system is installed.

46.9.1 Flammable or combustible liquid. The use of a flammable of combustible liquid for the extraction of oils and fats from marijuana shall comply with this section.

   46.9.1.1 Scope. The use of flammable and combustible liquids for liquid extraction process where the liquid is boiled, distilled, or evaporated shall comply with this Chapter and NFPA 30.

   46.9.1.2 Location. The process using a flammable or combustible liquid shall be located within a hazardous exhaust fume hood, rated for exhausting flammable vapors. Electrical equipment used within the hazardous exhaust fume hood shall be rated for use in flammable atmospheres. Heating of flammable or combustible liquids over an open flame is prohibited.

   46.9.1.3 The use of a heating element not rated for flammable atmospheres may be approved where documentation from the manufacturer or an approved testing laboratory indicates is it rated for heating of flammable liquids.
Committee Input No. 137-NFPA 1-2015 [ Chapter 52 ]

Chapter 52 - Stationary Storage Battery Systems

52.1 - General.

Stationary storage battery systems having an electrolyte capacity of more than 100 gal (378.5 L) in sprinklered buildings or 50 gal (189.3 L) in unsprinklered buildings for flooded lead-acid, nickel-cadmium, and valve-regulated lead–acid (VRLA) batteries or 1000 lb (454 kg) for lithium-ion and lithium metal polymer batteries used for facility standby power, emergency power, or uninterrupted power supplies shall be in accordance with Chapter 52 and Table 52.1.

Table 52.1 Battery Requirements

<table>
<thead>
<tr>
<th>Nonrecombinant Batteries</th>
<th>Recombinant Batteries</th>
<th>Other Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flooded Lead-Acid</td>
<td>Flooded Nickel-Cadmium (Ni-Cd)</td>
<td>Thermal runaway management</td>
</tr>
<tr>
<td>Flooded Nickel-Cadmium</td>
<td>Valve-Regulated Lead–Acid (VRLA)</td>
<td>Not required</td>
</tr>
<tr>
<td>Lithium-Ion</td>
<td>Lithium Metal Polymer</td>
<td>Required</td>
</tr>
</tbody>
</table>

52.2 - Permits.

Permits, where required, shall comply with Section 1.12.

52.2.2 - Prior to installation, plans shall be submitted and approved by the AHJ.

52.3 - Safety Features.

52.3.1 - Safety Venting.

Batteries shall be provided with safety venting caps as follows in 52.3.1.1 through 52.3.1.3.

52.3.1.1 - Nonrecombinant Batteries.

Vented lead-acid, nickel-cadmium, or other types of nonrecombinant batteries shall be provided with safety venting caps.

52.3.1.2 - Recombinant Batteries.

VRLA or other types of sealed, recombinant batteries shall be equipped with self-resealing flame-arresting safety vents.

52.3.1.3 - Lithium-ion and lithium metal polymer batteries shall not require safety venting caps.

52.3.2 - Thermal Runaway.

VRLA, lithium-ion, and lithium metal polymer battery systems shall be provided with a listed device or other approved method to preclude, detect, and control thermal runaway.

52.3.3 - Location and Occupancy Separation.

52.3.3.1 - Battery systems shall be permitted in the same room as the equipment that they support.

52.3.3.2 - Battery systems shall be housed in a noncombustible, locked cabinet or other enclosure to prevent access by unauthorized personnel unless located in a separate equipment room accessible only to authorized personnel.

52.3.3.3 - In other than assembly, educational, detention and correction facilities, health care, ambulatory health care, day care centers, residential board and care, and residential occupancies, battery systems shall be located in a room separated from other portions of the building by a minimum of a 1-hour fire barrier.

52.3.3.4 - In assembly, educational, detention and correction facilities, health care, ambulatory health care, day care centers, residential board and care, and residential occupancies, battery systems shall be located in a room separated from other portions of the building by a minimum of a 2-hour fire barrier.

52.3.4 - Spill Control.

52.3.4.1 - Rooms, buildings, or areas containing free-flowing liquid electrolyte in individual vessels having a capacity of more than 55 gal (208 L) or multiple vessels having an aggregate capacity exceeding 1000 gal (3785 L) shall be provided with spill control to prevent the flow of liquids to adjoining areas.
52.3.4.2 An approved method and materials for the control of a spill of electrolyte shall be provided that will be capable of controlling a spill from the single largest vessel.

52.3.4.3 VRLA, lithium-ion, lithium metal polymer, or other types of sealed batteries with immobilized electrolyte shall not require spill control.

52.3.5 Neutralization.

52.3.5.1 An approved method to neutralize spilled electrolyte shall be provided.

52.3.5.2 For nonrecombinant batteries and VRLA batteries, the method shall be capable of neutralizing a spill from the largest battery to a pH between 7.0 and 9.0.

52.3.5.3 Lithium-ion and lithium metal polymer batteries shall not require neutralization.

52.3.6 Ventilation.

For flooded lead-acid, flooded nickel-cadmium, and VRLA batteries, ventilation shall be provided for rooms and cabinets in accordance with the mechanical code and one of the following:

(1) The ventilation system shall be designed to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the room during the worst-case event of simultaneous "boost" charging of all the batteries, in accordance with nationally recognized standards.

(2) Continuous ventilation shall be provided at a rate of not less than 1 ft\(^3\)/min/ft\(^2\) of floor area of the room or cabinet.

52.3.6.1 Lithium-ion and lithium metal polymer batteries shall not require ventilation.

52.3.7 Environment.

The battery environment shall be controlled or analyzed to maintain temperature in a safe operating range for the specific battery technology used.

52.3.8 Signs.

52.3.8.1 Doors or access doors into the following shall be provided with approved signs:

(1) Battery storage buildings
(2) Rooms containing stationary storage battery systems
(3) Other areas containing stationary storage battery systems

52.3.8.2 For rooms that contain Valve-Regulated Lead–Acid (VRLA), Lithium-Ion, or Lithium Metal Polymer batteries, the signs required by 52.3.8.1 shall state the following:

This room contains:

(1) Stationary storage battery systems
(2) Energized electrical circuits

52.3.8.3 For rooms that contain Flooded Lead-Acid or Flooded Nickel-Cadmium (Ni-Cd) batteries, the signs required by 52.3.8.1 shall state the following:

This room contains:

(1) Stationary storage battery systems
(2) Energized electrical circuits
(3) Corrosive battery electrolyte

52.3.8.4 Battery cabinets shall be provided with exterior labels that identify the manufacturer and model number of the system and electrical rating (voltage and current) of the contained battery system.
52.3.8.5 - Signs shall be provided within battery cabinets to indicate the relevant electrical, chemical, and fire hazard.

52.3.9 - Seismic Protection.
In seismically active areas, battery systems shall be seismically braced in accordance with the building code.

52.3.10 - Smoke Detection.
An approved automatic smoke detection system shall be installed in such areas and supervised by an approved central, proprietary, or remote station service or a local alarm that will give an audible signal at a constantly attended location.

See attachment.

Supplemental Information

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter_52_Stationary_Storage_Battery_Systems_with_HH_8-28_email.docx</td>
<td></td>
</tr>
</tbody>
</table>

Submitter Information Verification

Submitter Full Name: Kristin Bigda
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Submittal Date: Mon Oct 19 12:52:09 EDT 2015

Committee Statement

Committee Statement: Proposed Committee Input expands the scope of Chapter 52 to address energy storage systems (ESS) and not just stationary storage battery systems. The ESS requirements should cover battery systems, and/or fuel cells and other technologies such as chemical, mechanical and thermal that are being explored for use in today's energy conscience environment. It is desirable for the requirements to be compatible with other model codes and the National Electrical Code. UL 9540 Outline of Investigation for Energy Storage Systems and Equipment should be considered as a listing standard as it addresses a wide variety of energy storage technologies.

The use of ESS is rapidly expanding across North America and AHJs are facing the challenge of having to evaluate installations of new ESS technologies and applications in locations throughout the built environment. These include chemical (i.e. hydrogen fuel cells), mechanical (i.e. fly-wheel systems) and thermal technologies. Currently there are few if any fire code requirements in place to provide guidance on how to mitigate potential hazards. As this is being proposed as a Committee Input, additional comments and feedback from the public is anticipated and encouraged.

Response Message:

Public Input No. 285-NFPA 1-2015 [Section No. 52.3.5]
Public Input No. 172-NFPA 1-2015 [New Section after 52.3.10]
Public Input No. 250-NFPA 1-2015 [Chapter 52 [Title Only]]
Public Input No. 291-NFPA 1-2015 [New Section after 52.3.8.3]
Public Input No. 284-NFPA 1-2015 [New Section after 52.3.4]
Public Input No. 279-NFPA 1-2015 [New Section after 52.1]
Public Input No. 280-NFPA 1-2015 [Section No. 52.1]
Public Input No. 271-NFPA 1-2015 [New Section after 52.1]
Public Input No. 287-NFPA 1-2015 [Section No. 52.3.6]
Public Input No. 270-NFPA 1-2015 [New Section after 52.1]
Public Input No. 281-NFPA 1-2015 [Section No. 52.3.1]
Public Input No. 260-NFPA 1-2015 [Section No. 1.12.8]
Public Input No. 282-NFPA 1-2015 [Section No. 52.3.2]
Public Input No. 262-NFPA 1-2015 [Section No. 52.1]
Public Input No. 269-NFPA 1-2015 [Section No. 2.3.17]
Public Input No. 267-NFPA 1-2015 [Section No. A.52.1]
Public Input No. 289-NFPA 1-2015 [Section No. A.52.3.6]
1. Revise Chapter 52.

2. Add reference in Table 1.12.8 as follows:

<table>
<thead>
<tr>
<th>Battery systems</th>
<th>To install or operate the following stationary lead–acid battery storage systems:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. having an electrolyte capacity of more than 100 gal (378.5 L) in sprinklered buildings or 50 gal (189.3 L) in nonsprinklered buildings:</td>
</tr>
<tr>
<td></td>
<td>1. Stationary storage battery systems having an electrolyte capacity of more than 100 gal (378.5 L) in sprinklered buildings or 50 gal (189.3 L) in unsprinklered buildings for flooded lead–acid, nickel–cadmium, and valve-regulated lead–acid (VRLA) batteries,</td>
</tr>
<tr>
<td></td>
<td>2. Stationary storage battery systems utilizing lithium–ion and lithium metal polymer batteries with a power rating greater than 7 kWh (25.2 Mega joules)</td>
</tr>
<tr>
<td></td>
<td>3. Stationary storage battery systems utilizing battery technologies not covered in item (1) and (2) that exceed ten lbs. (4.6 kg).</td>
</tr>
</tbody>
</table>

52.2

3. Add reference in Chapter 2 as follows:


Chapter 52 Energy Systems

52.1* Electrical Energy Storage Systems

A.52.1 This section covers stationary battery systems that are typically used for facility standby power, emergency power, uninterrupted power supplies or load shedding/load balancing applications.

Stationary storage battery systems that exceed the amounts specified in items 1, 2, and 3 pose potential hazards that are significant enough to require compliance with the requirements in this chapter.

The requirements in Chapter 52 supersede all the hazardous material designations, permits, and requirements in Chapter 60.

52.1.1 General.
52.1.1.1 Energy storage systems having a capacity greater than the quantities listed in Table 52.1.1 shall be in accordance with Chapter 52 and where used as a legally required standby power system, shall also comply with 11.7.3.

### Table 52.1.1.1

**BATTERY THRESHOLD QUANTITIES**

<table>
<thead>
<tr>
<th>BATTERY TECHNOLOGY</th>
<th>CAPACITY (^{a})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead acid, all types</td>
<td>7 KWh (25.2 Mega joules)</td>
</tr>
<tr>
<td>Nickel cadmium (Ni-Cd),</td>
<td>5 KWh (3.6 Mega joules)</td>
</tr>
<tr>
<td>Lithium, all types</td>
<td>5 KWh (3.6 Mega joules)</td>
</tr>
<tr>
<td>Sodium, all types</td>
<td>5 KWh (3.6 Mega joules) (^{c})</td>
</tr>
<tr>
<td>Flow batteries(^{b})</td>
<td>5 KWh (3.6 Mega joules)</td>
</tr>
<tr>
<td>Other battery technologies</td>
<td>3 KWh (3.6 Mega joules)</td>
</tr>
</tbody>
</table>

\(^{a}\) – For batteries rated in Amp-Hours, KWh shall equal rated voltage times amp-hour rating

\(^{b}\) – Shall include vanadium, zinc-bromine, polysulfide-bromide, and other flowing electrolyte type technologies

\(^{c}\) – 7 KWh for sodium-ion technologies

52.1.2 Listings and approvals.

52.1.3 Stationary Battery Energy storage systems shall comply with the following:

1. Nickel-cadmium, and valve-regulated lead–acid (VRLA) batteries shall be approved or listed and labeled in accordance with the ANSI/UL1973 Standard for Batteries for Use in Light Rail Applications and Stationary Applications or the UL 9540 Outline of Investigation for Energy Storage Systems and Equipment. UL 1564 Standard for Industrial Battery Chargers.

2. Lithium-ion, lithium metal polymer, and other battery technologies not covered by item 1 shall be listed and labeled in accordance with the ANSI/UL1973 Standard for Batteries for Use in Light Rail Applications and Stationary Applications or the UL 9540 Outline of Investigation for Energy Storage Systems and Equipment.

   Exception: Lead-acid batteries.

52.1.4 Permits.

52.1.4.1 Operational Permits, shall be required and comply with Section 1.12 and Table 1.12.8(a).

52.1.4.2 Installation permits shall be required, submitted and approved by the AHJ.
52.1.5 Location and Occupancy Separation.

52.1.5.1 Battery systems shall be permitted in the same room as the equipment that they support.

52.1.5.2 Battery systems shall be housed in a noncombustible, locked cabinet or other enclosure to prevent access by unauthorized personnel unless located in a separate equipment room accessible only to authorized personnel.

52.1.5.3 In occupancies other than assembly, educational, detention and correction, health care, ambulatory health care, day care, residential board and care, and residential, battery systems shall be located in a room separated from other portions of the building by a minimum of a 1-hour fire barrier.

52.1.5.4 In assembly, educational, detention and correction, health care, ambulatory health care, day care, residential board and care, and residential occupancies, battery systems shall be located in a room separated from other portions of the building by a minimum of a 2-hour fire barrier.

NOTE: New Table 52.2 with Hazard Analysis to be included?

52.1.6 Hazard mitigation analysis for energy storage systems.

52.1.6.1 A fire risk and failure modes/effects analysis that includes information on hazard mitigation related to the following items associated with energy storage systems covered by Table 52.1 shall be provided to and approved by the AHJ.

52.1.6.2 The analysis, as required by 52.1.6.1, shall include information on the following:

(1) Safety venting
(2) Thermal runaway management
(3) Spill control
(4) Neutralization
(5) Ventilation
(6) Signage
(7) Seismic protection
(8) Fire detection
(9) Fire suppression
(10) Fire-resistance separation rating; both vertical and horizontal
(11) Gas detection

52.1.6.2 Safety Features.
52.1.6.2.1 Safety Venting.

52.1.6.2.1.1 Batteries shall be provided with flame arresting safety venting caps in accordance with 52.7.1.1 through 52.7.1.3 and Chapter 60.

52.1.6.2.1.2 Vented lead-acid, nickel cadmium, or other types of nonrecombinant batteries shall be provided with safety venting caps with flame arrestors.

52.1.6.2.1.3 VRLA or other types of sealed, recombinant batteries shall be equipped with self-resealing flame-arresting safety vents to relieve over-pressure.

52.1.6.2.1.4 Lithium-ion and lithium metal polymer batteries shall not require safety venting caps but shall include an approved means to relieve over-pressure.

52.1.6.2.2 Thermal Runaway. VRLA, lithium-ion, and lithium metal polymer energy storage systems shall be provided with a listed device or other approved method to preclude, detect, and control conditions that can lead to a thermal runaway.

52.1.7. Stationary Battery Energy Storage Location and Occupancy Separation.

52.1.7.1 Energy storage systems shall be permitted in the same room as the equipment that they support.

52.1.7.2 Energy storage systems shall be housed in a noncombustible, locked cabinet or other enclosure to prevent access by unauthorized personnel unless located in a separate equipment room accessible only to authorized personnel.

52.1.7.3 When installed in a building situated within a flood hazard area, the location of the energy storage system systems shall be in accordance with NFPA 5000 Building Construction and Safety Code, Section 52.2, or equivalent requirements of the locally adopted building code.

52.1.7.4 Energy storage systems in occupancies other than assembly, educational, detention and correction, health care, ambulatory health care, day care, residential board and care, and residential, energy storage systems shall be located in a room separated from other portions of the building by a minimum of a 1-hour fire barrier.

52.1.8 Spill Control.
52.1.8.1 Rooms, buildings, or areas containing free-flowing liquid electrolyte in individual vessels having a capacity of more than 55 gal (208 L) or multiple vessels having an aggregate capacity exceeding 1000 gal (3785 L) shall be provided with spill control to prevent the flow of liquids to adjoining areas.

52.1.8.2* An approved method and materials for the control of a spill of electrolyte shall be provided that will be capable of controlling a spill from the single largest vessel.

52.1.8.3 VRLA, lithium-ion, lithium metal polymer, or other types of sealed batteries with immobilized electrolyte shall not require spill control.

52.1.9 Neutralization.

52.1.9.1* An approved method to neutralize spilled corrosive electrolyte shall be provided. It shall be capable of neutralizing a spill from the largest battery to a pH between 7.0 and 9.0.

52.1.9.2 For nonrecombinant batteries and VRLA batteries, the method shall be capable of neutralizing a spill from the largest battery to a pH between 7.0 and 9.0.

52.1.9.3 Lithium-ion and lithium metal polymer batteries shall not require neutralization

52.1.10.* Ventilation.

A.52.1.10 Ventilation should be provided for flooded lead-acid, flooded nickel cadmium, and VRLA batteries, which can produce hydrogen. Ventilation is not needed for Lithium-ion and lithium metal polymer batteries, which do not produce flammable gas.

Information on battery room ventilation can be found in IEEE 1635/ASHRAE 21, Guide to Battery Room Ventilation and Thermal Management.

52.1.10.1 For batteries that can vent hydrogen or other flammable gas, ventilation shall be provided for rooms and cabinets in accordance with one of the following:

1. The ventilation system shall be designed to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the room during the worst-case event of simultaneous “boost” charging of all the batteries, in accordance with nationally recognized standards. For batteries that have the potential to produce other combustible gas, the ventilation system shall be designed to limit the maximum concentration of combustible gas to 25% of the LFL, or

2. Continuous ventilation shall be provided at a rate of not less than 1 ft3/min/ft2 (5.1 L/sec/m2) of floor area of the room or cabinet.

52.1.11 Environment. The battery environment shall be controlled or analyzed to maintain temperature in a safe operating range for the specific battery technology used.
52.1.12. Signage.

52.1.12.1 Signage identifying total energy storage system capacity (kWh) shall be posted on doors or in approved locations near entrances to stationary battery storage system rooms.

52.1.12.2 Approved signage indicating “danger” “warning” or “caution” shall be specific to the technology hazard of the battery type.

52.1.12.2.1 The sign shall be a minimum 8 in. (200 mm) wide and 6 in. (150 mm) high and shall include the following:

1. Hazard identification markings in accordance with NFPA 704.

2. Where the energy storage system disconnecting means is not within sight of the Main Service disconnecting means, placards or directories shall be installed at the locations of the Main Service indicating the location of all energy storage disconnecting means in accordance with NFPA 70.

52.1.12.2.2 Signs shall be provided on doors or in approved locations near entrances to stationary battery storage system rooms.

52.1.13 Seismic and structural design. shall be provided in accordance with the building code and shall not exceed the floor loading limitation of the building.

52.1.14 Fire detection. An approved automatic smoke detection system shall be installed in rooms containing stationary battery storage systems in accordance with NFPA 72.

52.1.15 Fire Command Centers. Buildings that require or have a fire command center shall have identified the location, size, voltage and disconnects for stationary stored energy battery systems as identified in 52.1.2.

52.1.16 Fire suppression. Rooms containing Stationary battery storage systems shall be protected by an automatic sprinkler system installed in accordance with NFPA 13.

52.1.16.1 Commodity classifications. Commodity classifications for the storage of lead acid, nickel cadmium, lithium-ion, sodium-beta, and flow batteries shall be in accordance with NFPA 13 Chapter 5.

52.1.17 Fire-resistance separation rating; both vertical and horizontal shall be in accordance with section 52.1.5

52.1.18 Toxic and highly toxic gases. Stationary battery systems that have the potential to release in excess of 20 cubic feet (0.566 m3) of toxic or highly toxic gas at
normal temperature and pressure (NTP) shall not be installed in Assembly, Educational, Institutional, Residential occupancies, or in occupied offices, retail sales and portions of Industrial and storage occupancies.

52.1.19 Mechanical ventilation. Ventilation of indoor areas containing stationary storage battery systems shall be provided in accordance with the Mechanical Code and the following:

1. The ventilation system shall be designed to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the room. For batteries that have the potential to produce other combustible gas, the ventilation system shall be designed to limit the maximum concentration of combustible gas to 25% of the LFL, or
2. Continuous ventilation shall be provided at a rate of not less than 1 cubic foot per minute per square foot (1 ft³/min/ft²) [0.0051 m³/s • m²] of floor area of the room.

52.1.20 Cabinet ventilation. Where batteries that have the potential to produce hydrogen or other combustible gases are installed inside a cabinet, the cabinet shall be approved for use in occupied spaces and shall be mechanically or naturally vented by one of the following methods:

1. The cabinet ventilation shall limit the maximum concentration of hydrogen to 1 percent of the total volume of the cabinet, or 25 % of the combustible gas LFL during the worst-case event of simultaneous “boost” charging of all the batteries in the cabinet.
2. Where calculations are not available to substantiate the ventilation rate, continuous ventilation shall be provided at a rate of not less than 1 cubic foot per minute per square foot [1 ft³/min/ft² or 0.0051 m³/(s • m²)] of floor area covered by the cabinet. The room in which the cabinet is installed shall be ventilated as required in 52.1.18.

52.1.21 Supervision. Mechanical ventilation systems, where required by 52.1.19 and 52.1.20 shall be supervised by an approved central station, proprietary or remote station service or shall initiate an audible and visual signal at an approved constantly attended on-site location.

52.1.22 Gas detection system. A gas detection system shall be provided to protect areas that have the potential to contain a flammable gas, toxic gas or highly toxic gas from stationary battery systems during normal charging, discharging or fault conditions. Systems designed to detect flammable gases shall activate mechanical ventilation complying with 52.1.18 when the level of flammable gas exceeds 25 percent of the lower flammable limit (LFL). Systems designed to detect toxic and highly toxic gases shall comply with NFPA 55.
52.1.23 Battery Management System. A battery management system shall be provided for the control and protection of the battery. The battery management system (BMS) shall provide monitoring of cell, module and battery voltages, module and battery current and cell temperatures. The BMS shall maintain the cells and batteries within the manufacturer’s specification for current, voltage and temperature. In addition, active cell balancing shall be provided for safety of the battery energy storage system.

52.1.24 Restricted access. Provisions shall be provided to prevent access to areas and cabinets containing stationary battery storage systems by unauthorized personnel.

52.1.25 Mixed battery systems.

52.1.12.1 When areas within buildings containing stationary battery storage systems include different types of batteries, the total aggregate quantities of batteries shall be determined based on the sum of percentages of actual quantities divided by the maximum allowable quantities of each battery type. If the sum of the percentages exceeds 100%, the area shall be treated as a hazardous area.

52.1.25.2 If Batteries of different chemistries are mixed in any enclosed locations they are to be approved by the fire code official based on a hazard mitigation analysis conducted in accordance with 52.1.6.

52.1.26 Spacing. Batteries, prepackaged stationary battery storage systems and pre-engineered stationary battery storage systems shall be segregated into storage arrays not exceeding 400 KWh each. Each array shall be spaced a minimum three feet (914 mm) from other battery arrays and from walls in the storage area.

   Exceptions:
   1. Individual lead acid battery arrays shall be not exceed 500 KWh.
   2. Individual arrays of prepackaged stationary battery storage systems and pre-engineered stationary battery storage systems encased in metal enclosures shall be permitted to not exceed 500 KWh.

52.1.27 System classification. Stationary battery storage systems shall be classified as one of the following types:

   1. Batteries
   2. Pre-packaged battery storage systems.
   3. Pre-engineered battery storage systems

52.1.28 Chargers. Capacitor chargers shall be compatible with the capacitor system charging specifications.
52.1.29 **Inverters.** Inverters shall be listed and labeled in accordance with UL 1741 or UL 62109-1. Only inverters listed and labeled for utility interactive system use and identified as interactive shall be permitted to operate in parallel with the electric utility power system to supply power to common loads.

52.1.30 **Battery specific protection.** Stationary battery systems shall comply with Section 52.1.30 requirements based on the type of battery technology utilized in the system. See Section 52.1.25 for mixed battery systems.

52.1.30.3.1 **Lead acid batteries.** Stationary battery systems utilizing lead acid batteries, shall comply with 52.1.30.3.1.

52.1.30.3.1.1 **Spill control and neutralization.** Spill control and neutralization shall be provided for areas and cabinets containing lead-acid batteries in accordance with 52.1.8 and 52.1.9.

**Exception:** Spill control and neutralization shall not be required for sealed lead acid batteries with immobilized electrolyte.

52.1.30.3.1.2 **Ventilation.** Areas containing lead acid batteries shall be provided with ventilation in accordance with 52.1.10.

52.1.30.3.1.3 **Gas Detection.** Gas detection for vented lead acid batteries shall be provided in accordance with 52.1.22.

52.1.30.3.1.4 **Signage.** Signage shall be provided in accordance with 52.1.12.2 and shall include the following or equivalent wording:

```
CAUTION – Corrosive Liquids
This room contains lead acid batteries and energized electrical circuits. Hydrogen gas may be present.
```

52.1.30.3.2 **Nickel cadmium (Ni-Cd) batteries.**

52.1.30.3.2.1 **Spill control and neutralization.** Spill control and neutralization shall be provided for areas containing flooded nickel cadmium storage batteries containing free flowing electrolyte in accordance with 52.1.8 and 52.1.9

52.1.30.3.2.2 **Ventilation.** Areas containing nickel cadmium batteries shall be provided with ventilation in accordance with Section 52.1.10.
52.1.30.3.3 Lithium-ion batteries.

52.1.30.3.3.1 Ventilation. Areas containing lithium-ion batteries shall be provided with ventilation in accordance with 52.1.10.

52.1.30.3.3.2 Signage. Signage shall be provided in accordance with 52.1.12.2 and shall include the following or equivalent wording:

CAUTION – Thermal Runaway Hazard
This room contains lithium-ion batteries and energized electrical circuits.

52.1.30.3.X Lithium metal batteries.

Need a new section?

52.1.30.3.4 Sodium beta batteries.

52.1.30.3.4.1 Gas detection. Gas detection (SO\textsubscript{2}) for sodium sulfur batteries shall be provided in accordance with 52.1.22.

52.1.30.3.4.2 Signage. Signage shall be provided in accordance with 52.1.12.2 and shall include the following or equivalent wording:
DANGER – Water Reactive Hazards
This room contains sodium beta batteries and energized electrical circuits.
APPLY NO WATER

52.1.30.3.5 Flow batteries.

52.1.30.3.5.1 Spill control and neutralization. Spill control and neutralization shall be provided for areas containing flowing electrolyte storage batteries in accordance with 52.1.8 and 52.1.9.

52.1.30.3.5.2 Ventilation. Areas containing flow batteries shall be provided with ventilation in accordance with 52.1.10.

52.1.30.3.5.3 Gas detection. Gas detection for flow batteries shall be provided in accordance with 52.1.22.

52.1.30.3.5.4 Signage. Signage shall be provided in accordance with 52.1.12.2 and shall include the following or equivalent wording:

CAUTION – Corrosive Liquids
This room contains flow batteries and energized electrical circuits. Hydrogen gas may be present.

52.1.30.3.6 Other battery technologies.

52.1.30.3.6.1 Spill control and neutralization. Spill control and neutralization shall be provided for areas containing batteries with free flowing electrolytes or other hazardous materials in liquid form in accordance with 52.1.8 and 52.1.9.

52.1.30.3.6.2 Ventilation. Areas containing batteries that have the potential to release flammable gas under charging, discharging, and fault conditions shall be provided with ventilation in accordance with Section 52.1.10.

52.1.31 Electrical Capacitors. Capacitor energy storage systems having capacities more than 7 KWh (25.2 Mega joules) shall comply with this section.

52.1.31.1 Listings and Approvals. Capacitor systems and capacitor energy storage systems shall comply with one of the following:
1. Electrochemical or other capacitor systems/packs shall be listed and labeled in accordance with UL1973.

2. Prepackaged capacitor energy storage systems shall be listed and labeled in accordance with UL 9540.

3. Pre-engineered capacitor energy storage systems shall be listed and labeled in accordance with UL 9540.

4. Capacitor energy storage systems that are not pre-packaged or pre-engineered shall have all component parts including, but not limited to monitors, controls, switches, breakers, power conversion systems, inverters, transformers, capacitors and other components of the electrochemical energy storage system listed and labeled for the intended application as a part of an capacitor energy storage system.

52.1.31.2 Permits.

52.1.31.2.1 Operational Permits, shall be required and comply with Section 1.12 and Table 1.12.8(a).

52.1.31.2.2 Installation permits shall be required, submitted and approved by the AHJ.

52.1.31.3 Prepackaged and pre-engineered systems. Prepackaged and pre-engineered electrochemical capacitor energy storage systems shall be installed in accordance with their listing and the manufacturer's instructions.

52.1.31.4 Signs.

52.1.31.4.1 Danger, Warning and Caution signage shall be specific to the technology hazard of the battery type. Approved signs or their equivalent shall be provided on doors or in approved locations near entrances to stationary battery storage system rooms. The approved sign shall be a minimum 8 in. (200 mm) wide and 6 in. (150 mm) high and indicate Cautions, Warnings and Dangers for the appropriate hazards and shall include the following:

1. Hazard identification markings in accordance with NFPA 704.

2. Where the energy storage system disconnecting means is not within sight of the Main Service disconnecting means, placards or directories shall be installed at the locations of the Main Service indicating the location of all energy storage disconnecting means in accordance with NFPA 70.

52.1.31.4.1.2 For rooms that contain Electrical Capacitors the signs required by 52.1.12.2 shall state the following or equivalent wording:
52.1.31.4.1.3 Battery cabinets shall be provided with exterior labels that identify the manufacturer and model number of the system and electrical rating (voltage and current) of the contained battery system.

52.1.31.4.1.4 Signs shall be provided within battery cabinets to indicate the relevant electrical, chemical, and fire hazard.

52.1.31.5 Seismic Protection. In seismically active areas, energy storage systems shall be seismically braced in accordance with the building code.

52.1.31.6 Smoke Detection. An approved automatic smoke detection system shall be installed in such areas and supervised by an approved central, proprietary, or remote station service or a local alarm that will give an audible signal at a constantly attended location.

52.2 Energy Generating Systems

52.2.1 Hydrogen Fuel Cells

52.2.1.2 Listings and Approvals

52.2.1.2.1 Hydrogen Fuel Cells with a power rating greater than 50Kw shall comply with the following:

1. **Prepackaged fuel cell power systems** shall be listed and labeled in accordance with CSA FC 1.

2. The modules and components in a **pre-engineered fuel cell power system** shall be listed and labeled in accordance with CSA FC 1 and interconnected at the job site in accordance with this code, NFPA 2 and the manufacturer’s instructions, within their listings.

3. **Field fabricated fuel cell power systems** equipment and installation shall comply with NFPA 2, NFPA 70 Article 706 and NFPA 853.

52.2.1.2 Permits.

52.2.1.2.1 Operational Permits, shall be required and comply with Section 1.12 and Table 1.12.8(a).

52.2.1.2.2 Installation permits shall be required, submitted and approved by the AHJ.
52.2.1.3 **Stationary fuel cell power systems** shall be installed and maintained in accordance with NFPA 2, NFPA 70 Article 706 and NFPA 853, the manufacturer’s installation instructions, and their listing.

52.2.1.4 **Stationary fuel cell power systems** shall only be used in nonresidential installations unless they are specifically listed for residential use.

52.2.1.5 **Stationary fuel cell power systems** installed in indoor locations shall comply with this section.

52.2.1.5.1 The **stationary fuel cell power systems** installed indoors or under canopies attached to the building shall be specifically listed and marked for indoor use.

52.2.1.5.2 **Stationary fuel cell power systems** installed indoors shall be treated as an incidental use area and be separated from normally occupied portions of Business, Industrial, Storage occupancies by one-hour fire resistive construction, and from occupied portions of Group Assembly, Educational, Institutional and Residential occupancies by two-hour fire resistive construction. Separation shall be provided in accordance with the building code.

**Exception 1:** **Stationary fuel cell power systems** shall be permitted in normally occupied Industrial and Storage occupancies provided the areas are separated from other Business, Industrial, Storage occupancies by one-hour fire resistive construction, and from occupied portions of Group Assembly, Educational, Institutional and Residential occupancies by two-hour fire resistive construction.

**Exception 2:** **Stationary fuel cell power systems** rated less than 50 Kw shall not be required to be separated from other occupancies provided the systems comply with NFPA 853, Section 9.3 requirements.

52.2.1.6 **Vehicle impact protection.** Where **stationary fuel cell power systems** are subject to impact by a motor vehicle, vehicle impact protection shall be provided in accordance with Chapter 42.

52.2.1.7 **Separation.** **Stationary fuel cell power systems** located outdoors shall be separated by minimum five feet (1524 mm) from the following:

- Lot lines
- Public ways
- Buildings
- Stored combustible materials
- Hazardous materials
- High-piled stock
52.2.1.8 Fuel supply. The design, location and installation of the fuel supply for stationary fuel cell power systems shall comply with NFPA 2, Chapter 53 and Chapter 58.

52.2.1.9 Manual shutoff. An accessible manual shutoff valve shall be provided for the fuel piping within 6 feet (1.8m) of the fuel storage tank and within 6 feet (1.8 m) of the power system. If the fuel tank and the stationary fuel cell power system are less than 12 feet (3.6 m) apart, a single shutoff valve will be acceptable. If the stationary fuel cell power system is located indoors the shutoff valve shall be located outside of the room in which the power unit is installed, unless otherwise approved by the AHJ.

52.2.1.10 Ventilation and exhaust. Ventilation and exhaust for indoor and outdoor systems shall be provided in accordance with NFPA 2, and NFPA 853.

52.2.1.11 Fire suppression. Fire suppression for indoor and outdoor installations shall be provided in accordance with NFPA 2, NFPA 13 and NFPA 853.

52.2.1.12 Gas detection systems. Gas detection systems for indoor installations shall be provided in accordance with NFPA 2 and NFPA 853.

52.3. Wind Generators Reserved

52.4 Photovoltaic Reserved

52.5 Solar Reserved

52.6 Hydroelectric Reserved

52.7 Other Reserved
53.3.1.1 General.
Refrigeration systems shall be operated and maintained in a safe and operable condition, free from accumulations of oil, dirt, waste, excessive corrosion, other debris, or leaks, and in accordance with ASHRAE 15 and the mechanical code. Ammonia refrigerator systems shall be operated and maintained in accordance with ANSI/IIAR 6, Maintenance and Inspection of Closed-Circuit Ammonia Refrigeration Systems, and ANSI/IIAR 7, Developing Operating Procedures for Closed-Circuit Ammonia Mechanical Refrigerating Systems.

Submitter Information Verification
Submitter Full Name: Kristin Bigda
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Submittal Date: Mon Oct 19 20:05:59 EDT 2015

Committee Statement
Committee Statement: IIAR 6 is a new standard that provides regulations for maintenance and inspection of closed-circuit ammonia refrigeration systems. ANSI/IIAR 6 is not yet complete, but it is anticipated to be complete prior to conclusion of the current NFPA 1 cycle.
Response Message:
Committee Input No. 162-NFPA 1-2015 [ Chapter 55 ]

Chapter 55
- Reserved Reserved
- Cleaning and Purging of Flammable Gas Piping Systems

55.1 Cleaning and purging activities for new and existing flammable gas piping found in electric generating plants and in industrial, institutional, and commercial applications shall comply with NFPA 56, Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems.

Submitter Information Verification

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Submittal Date: Thu Oct 22 10:25:49 EDT 2015

Committee Statement

Committee Statement: NFPA 56 applies to fire and explosion prevention during cleaning and purging activities for new and existing flammable gas piping found in electric-generating plants and in industrial, institutional, and commercial applications. NFPA 56 was developed in direct response to the explosion and subsequent fatalities at the Kleen Energy natural gas-fired power plant in Middletown, CT. The committee agreed that NFPA 56 addresses an important subject that should be referenced in some part in NFPA 1. Additional review of NFPA 56 will be completed prior to the Second Draft stage.

Response Message:
Committee Input No. 144-NFPA 1-2015 [ New Section after 60.5.2 ]

60.5.3 **Egress.** Egress from areas required to comply with Protection Level 1, Protection Level 2, Protection Level 3, Protection Level 4 or Protection Level 5 shall comply with 60.5.3, and egress from areas required to comply with Protection Level 5 shall also comply with 34.3.7 of NFPA 5000. [5000: 34.3.2.4]

60.5.3.1 **Travel Distance Limit.** Travel distance to an exit from areas required to comply with Protection Level 1 through Protection Level 5 shall not exceed the distance given in Table 60.5.3.1, measured as required in Section 11.6.3 of NFPA 5000. [5000: 34.3.2.4.1]

Table 60.5.3.1 [5000: Table 34.3.2.4.1]

<<Insert Table 34.3.2.4.1 from NFPA 5000 2018 edition>>

60.5.3.2 **Capacity of Means of Egress.** Egress capacity for high hazard contents areas shall be based on 0.7 in. (18 mm) per person for stairs or 0.4 in. (10 mm) per person for level components and ramps in accordance with 14.8.3.1. [5000: 34.3.2.4.2]

60.5.3.3 **Number of Means of Egress.** Not less than two means of egress shall be provided from each building, or portion thereof, required to comply with Section 60.2 through 60.6, unless rooms or spaces do not exceed 200 ft² (18.6 m²), have an occupant load not exceeding three persons, and have a travel distance to the room door not exceeding 25 ft (7.6 m). [5000: 34.3.2.4.3]

60.5.3.4 **Dead Ends.** Means of egress, other than rooms or spaces that do not exceed 200 ft² (18.6 m²), have an occupant load not exceeding three persons, and have a travel distance to the room door not exceeding 25 ft (7.6 m), shall be arranged so that there are no dead ends in corridors. [5000: 34.3.2.4.4]

60.5.3.5 **Doors.** Doors serving high hazard contents areas with occupant loads in excess of five shall be permitted to be provided with a latch or lock only if the latch or lock is panic hardware or fire exit hardware complying with 14.5.3.4. [5000: 34.3.2.4.5]

60.5.3.6 **Common Path of Travel Distance Limit.** The common path of travel distance from areas required to comply with Protection Level 1 through Protection Level 5 shall not exceed the distance given in Table 60.5.3.6, measured as required in NFPA 5000 11.6.3. [5000: 34.3.2.4.6]

Table 60.5.3.6 Common Path of Travel Distance Limits

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[5000: Table 34.3.2.4.8]

Submitter Information Verification

Submitter Full Name: Kristin Bigda
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Submittal Date: Mon Oct 19 15:07:01 EDT 2015

Committee Statement

Committee Statement: Because no specific limit for common path of travel exists, inappropriate distances could be used for this critical means of egress element.

Basis for 25 foot distance: For Hazard Levels 1-3 the primary hazard is a physical one. During fire conditions, physical hazards (which may be open or closed use or storage, can dramatically and rapidly change fire characteristics. Therefore the distance one much travel until there are two distinct paths of travel to an exit must be limited in length. 25 feet is a reasonable distance limit for such conditions.

Basis for 75 foot distance. Per NFPA 101, the common path of travel in a sprinklered industrial or storage occupancy is 100 feet (50 feet if un-sprinklered). All PL-4 and PL-5 areas are required to be sprinklered regardless, so a common path limit for a non-sprinklered PL-4, 5 area need not be developed – it is not allowed. As a high hazard area, the common path distance for a PL-4 or PL-5 area should be less than that allowed for a storage or industrial occupancy. During normal conditions, the health hazards associated with toxic solids and liquids are required to be controlled – that is there are robust requirements for
containers, piping, etc. that are already required both by NFPA 400 and applicable fire codes as well as various health hazard requirements (related to industrial hygiene) that prevent the release of toxic or highly toxic solids and liquids into occupied areas during normal operation. During a fire condition, release is possible, and egress is needed prior to the development of untenable conditions, either due to products of combustion and heat from the fire or due to release of the toxic or highly toxic solids or liquids due to a fire induced breach of their containment. The fire sprinklers would frequently be expected to eliminate a release, but that is not always the case. This possible release warrants a reduction in the 100 foot common path of travel distance from that allowed for the base occupancies, but not so much as would be required for physical hazards (PL 1-3 areas) and more than would be allowed for an un-sprinklered base occupancy (50 feet). Therefore 75 feet is a reasonable distance for the common path of travel distance for a sprinklered PL-4 health hazard area.

Public Input No. 293-NFPA 1-2015 [New Section after 60.5.2]
Committee Input No. 130-NFPA 1-2015 [Section No. 63.9]

63.9 - Insulated Liquid Carbon Dioxide Systems.

Insulated liquid carbon dioxide systems shall comply with Chapter 13 of NFPA 55.

See attachment.

Supplemental Information

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<th>Description</th>
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<tr>
<td>C02_CI.docx</td>
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</table>

Submitter Information Verification

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Submittal Date: Mon Oct 19 11:45:25 EDT 2015

Committee Statement

Committee Statement: The use of CO2 and other simple asphyxiants has become prevalent in restaurants, mercantile, mercantile and other non-industrial facilities that utilize these gases for beverage dispensing and other applications. There have been fatalities in some of these facilities due to asphyxiation. The draft was developed through a task force made up of industry associations, interested individuals and regulators. The text is being proposed in the form of a Committee Input as additional comments from the public are requested and encouraged.

Response

Message:

Public Input No. 225-NFPA 1-2015 [Global Input]
Chapter 63 Compressed Gases and Cryogenic Fluids

63.9 Insulated Liquid Carbon Dioxide Systems. Insulated liquid carbon dioxide systems shall comply with Chapter 13 of NFPA 55.

63.9.1 General. The storage, use, and handling of liquid carbon dioxide in insulated systems shall be in accordance with the provisions of NFPA 55 Chapter 13 and chapters 1 through 7 as applicable.

63.9.2 Carbon dioxide (CO₂) systems. For other than vehicles equipped for and using compressed gas as a fuel for propelling the vehicle, an operational permit is required for liquid carbon dioxide systems in excess of 100 pounds (45.4 kg) of carbon dioxide:

63.9.3 Carbon dioxide (CO₂) systems.

63.9.3.1 A construction permit is required for the installation of or modification to liquid carbon dioxide (CO₂) system where the quantity exceeds the amount listed in 63.9.2.

63.9.3.2 The following information shall be provided to the authority having jurisdiction with the application for permit:

1. Total aggregate quantity of liquid CO₂ in pounds or cubic feet at normal temperature and pressure.
2. Location and total volume of the room where the liquid CO₂ will be located. Identify whether the room is at grade or below grade.
3. Location of containers relative to equipment, building openings and means of egress.
4. Manufacturer’s specifications and pressure rating, including cut sheets, of all piping and/or tubing to be used.
5. A piping and instrumentation diagram that shows piping support and remote fill connections.
6. Details of container venting, including but not limited to vent line size, material and termination location.
7. Alarm and detection system and equipment, if applicable.
8. Seismic support for containers.

63.9.4 Pressure Relief Devices. Containers used for liquid carbon dioxide shall be equipped with pressure relief devices piped from the uppermost part of the containers and communicating with the vapor space. [55:13.3.1]

63.9.5 Physical Protection. Pressure relief devices shall be located to minimize tampering, damage, and obstruction to flow. [55:13.3.1.1.1]

The inlet and outlet of the relief devices shall not be blocked by a valve or plug during normal operation. [55:13.3.1.1.2]
63.9.6 Vent Pipe Systems. Pressure relief devices shall be piped to the outdoors where the discharge will not impinge on the structure, personnel, or means of egress and will not create a hazardous concentration of carbon dioxide. [55:13.3.1.2]

63.9.6.1 Pressure relief devices from portable DOT 4L containers that are not a component of a stationary system shall not be required to meet the requirements of 63.9.6. [55:13.3.1.2.1]

63.9.6.2 Vent piping systems serving pressure relief devices shall be protected from water intrusion to prevent moisture or solid carbon dioxide from collecting and freezing and interfering with the operation of the pressure relief device. [55:13.3.1.2.2]

63.9.6.3 Vent piping systems serving pressure relief devices shall be designed to prevent backflow restrictions exceeding 10 percent backpressure on the pressure relief device under full flow conditions. [55:13.3.1.2.3]

63.9.7 Pressure and Level Indicators.

63.9.7.1 Cylinders, containers, and tanks shall be provided with a pressure gauge and a level gauge or device for indicating the quantity of liquid carbon dioxide. [55:13.3.2.1]

63.9.7.2 These devices shall be designed for the temperatures and pressures associated with liquid carbon dioxide service. [55: 13.3.2.2]

63.9.7.3 Where cylinders, containers, and tanks are in locations remote from the filling connection, a means to determine when the containers have been filled to their design capacity shall be provided and shall be verifiable from the filling connection. [55:13.3.2.3]

63.9.8 Piping Systems.

63.9.8.1 Carbon dioxide piping shall be located and supported to protect against damage from strain on piping and fittings; the effects of expansion, contraction, and vibration; mechanical damage; and heat sources. [55: 13.3.3.1]

63.9.8.2 Piping, tubing, and hoses and fittings shall be designed to a bursting pressure of at least four times the system design pressure. [55: 13.3.3.2]

63.9.8.3 Materials of Construction. Materials of construction shall be employed for potential exposure to a temperature of -109.3°F (-78.5°C). [55: 13.3.4]

63.9.8.4 Operating Instructions. Operating instructions shall account for potential exposure of personnel to extremely low temperatures in accordance with 63.9.13. [55:13.5]

63.9.9 Safety measures.
63.9.9.1 Rooms or areas inside Assembly, Business, Educational, Institutional and Residential occupancies containing a liquid carbon dioxide (CO\textsubscript{2}) system shall comply with the safety measures in Section 63.9.9.1.

63.9.9.2 The provisions of 63.9.9.1 shall not apply to Liquid carbon dioxide (CO\textsubscript{2}) systems located above grade in outdoor areas with enclosure walls obstructing on no more than 75% of the perimeter at ground level.

63.9.9.3 Gas detection system.

63.9.9.3.1 A continuous gas detection system shall be provided in the room or area where container systems are filled and used, and in areas where the heavier than air gas can congregate.

63.9.9.3.2 Carbon dioxide (CO\textsubscript{2}) sensors shall be provided within 12 inches (305 mm) of the floor in the area where the gas is most likely to accumulate or leaks are most likely to occur.

63.9.9.3.3 The system shall be designed to detect and notify at a low level alarm and high level alarm.

63.9.9.4 The threshold for activation of the low level alarm shall not exceed a carbon dioxide concentration of 5,000 ppm TWA (9,000 mg/m\textsuperscript{3}). When carbon dioxide is detected at the low level alarm, the system shall activate a signal at a normally attended location within the building.

63.9.9.5 The threshold for activation of the high level alarm shall not exceed a carbon dioxide concentration of 30,000 ppm (54,000 mg/m\textsuperscript{3}). When carbon dioxide is detected at the high level alarm, the system shall activate an audible and visual alarm in an approved location.

63.9.10 Signage.

63.9.10.1 Hazard identification signs shall be posted at the entrance to the room and confined area where liquid carbon dioxide containers are located. The sign shall be a minimum 8 in. (200 mm) wide and 6 in. (150 mm) high and indicate:

\begin{center}\textbf{CAUTION – CARBON DIOXIDE GAS}
Ventilate the area before entering.
A high carbon dioxide (CO2) gas concentration
In this area can cause asphyxiation.\end{center}

63.9.11 Performance design option.
63.9.11.1 Carbon dioxide (CO₂) systems shall not be required to be provided with a gas detection system where a complete discharge of the stored carbon dioxide cannot result in a concentration exceeding 5,000 ppm in the room where the container is located or the area where the carbon dioxide is likely to congregate. The maximum concentration (ppm) shall be determined as follows:

1. Calculate the volume (scf) of CO₂ gas at standard temperature and pressure that is contained in the storage containers.
   1.1. To convert pounds of liquid to volume (scf) of CO₂ gas, multiply the pounds by 8.741.
   1.2. To convert gallons of liquid to volume (scf) of CO₂ gas, multiply the gallons by 74.04.

2. Calculate the volume of the room containing the CO₂ containers, or the area where the CO₂ is likely to congregate, in cubic feet.
   2.1. The volume of the room or area shall be based on a height limitation of 5 feet (1524 mm) or the ceiling, whichever is less.
   2.2. The boundary of the area shall be to walls or partitions 5 feet (1524 mm) or more in height that obstruct gas dispersion at the floor level.
   2.3. All doors in the boundary walls shall be considered closed.
   2.4. CO₂ shall be assumed to congregate in basements, pits or lower floors where openings are present between the containers and the lower floor.

3. Divide the volume of CO₂ gas by the volume of the room. If the result does not exceed 0.005 (5,000 ppm) the design meets the performance option criteria.

63.9.12 Seismic and structural design.

63.9.12.1 Liquid carbon dioxide system containers and piping shall comply with the seismic design requirements in accordance with the Building Code and shall not exceed the floor loading limitation of the building.

63.9.12.2 Container foundations or floors in multistoried buildings shall be designed to support the weight of the system at its full capacity in accordance with the Building Code.

63.9.13 Small Insulated Liquid Carbon Dioxide Outdoor Systems.

63.9.13.1 Container systems located in enclosed spaces shall be in accordance with Section 63.9.1 for indoor systems.

63.9.13.2 Aboveground outdoor locations shall not be required to be provided with a gas detection and alarm system in accordance with 63.9.1 where the system is unenclosed.
63.9.13.3 To be considered unenclosed, enclosures constructed to limit access or otherwise provide a visual or architectural barrier for the installation shall be constructed in accordance with the requirements in Section 6.6 for weather protection or with the Following:
(1) The enclosure shall be constructed without a roof or overhead cover.

(2) Supports and walls shall not obstruct more than three sides nor more than 75 percent of the perimeter of the storage or use area, with 25 percent of the perimeter being open to the atmosphere. [55:13.7.1.1]

63.9.13.4 Enclosures that do not meet the requirements of 63.9.14.2 shall be permitted when constructed in accordance with the following:
(1) The enclosure shall be constructed without a roof or overhead cover.

(2) Continuous mechanical exhaust ventilation shall be provided. [55:13.7.1.2]

63.9.13.5 Where mechanical exhaust ventilation is provided, it shall be in accordance with the following:
(1) The exhaust system shall be installed in accordance with the requirements of the mechanical code.

(2) The exhaust system shall be designed to consider the density of the potential vapors released with exhaust taken from a point within 12 in. (305 mm) of the floor.

(3) The location of both the exhaust and the inlet air openings shall be designed to provide air movement across all portions of the enclosure to prevent the accumulation of vapors.

(4) The rate of exhaust ventilation shall be not less than 1 scf/min/ft² (0.028 Nm³/min/m²) of floor area within the enclosure. [55:13.7.1.2.1]

63.9.14 Large Indoor Insulated Liquid Carbon Dioxide Systems. (Reserved)

63.9.15. Large Outdoor Insulated Liquid Carbon Dioxide Systems.

63.9.15.1 Location. Outdoor stationary large insulated liquid carbon dioxide systems shall be located in accordance with Table 63.9.15.1. [55:13.9.1]

Table 63.9.15.1 Minimum Separation Distance Between Outdoor Stationary Large Insulated Liquid Carbon Dioxide Containers and Exposures

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<thead>
<tr>
<th>Exposure</th>
<th>Distance</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Distance</td>
<td>ft</td>
</tr>
<tr>
<td>------------------</td>
<td>----</td>
</tr>
<tr>
<td>(1) Buildings, regardless of construction type</td>
<td>2</td>
</tr>
<tr>
<td>(2) Wall openings other than building exits</td>
<td>2</td>
</tr>
<tr>
<td>(3) Air intakes</td>
<td>10</td>
</tr>
<tr>
<td>(4) Property lines</td>
<td>5</td>
</tr>
<tr>
<td>(5) Places of public assembly (assembly occupancies)</td>
<td>50</td>
</tr>
<tr>
<td>(6) Nonambulatory patient areas</td>
<td>50</td>
</tr>
<tr>
<td>(7) Combustible materials, (e.g., paper, leaves, weeds, dry grass, debris)</td>
<td>15</td>
</tr>
<tr>
<td>(8) Incompatible hazardous materials</td>
<td>20</td>
</tr>
<tr>
<td>(9) Building exits</td>
<td>10</td>
</tr>
</tbody>
</table>

**63.9.15.2** Point-of-Fill Connections. Point-of-fill connections serving stationary containers filled by mobile transport equipment shall not be positioned closer to exposures than the minimum distances in Table 63.9.15.1. [55:13.9.1.1]

**63.9.15.3** Fire Barriers. A 2-hour fire barrier wall shall be permitted in lieu of the distances specified by Table 63.9.15.1 when in accordance with the provisions of 63.9.15.4 through 63.9.15.8.

**63.9.15.4** The fire barrier wall shall be without openings or penetrations.

**63.9.15.5** Penetrations of the fire barrier wall by conduit or piping shall be permitted provided that the penetration is protected with a firestop system in accordance with the Building Code.

**63.9.15.6** The fire barrier wall shall be either an independent structure or the exterior wall of the building adjacent to the storage system.

**63.9.15.7** The fire barrier wall shall be located not less than 5 ft (1.5 m) from any exposure.

**63.9.15.8** The fire barrier wall shall not have more than two sides at approximately 90 degree (1.57 rad) directions or not more than three sides with connecting angles of approximately 135 degrees (2.36 rad).
Committee Input No. 113-NFPA 1-2015 [ New Section after E.2.5 ]

Annex F  Fire Fighter Breathing Air Replenishment Systems

This annex is not a part of the requirements of this NFPA document unless specifically adopted by the AHJ.

F.1  General.

Where required by the AHJ, fire fighter breathing air replenishment systems shall comply with Appendix F of the Uniform Plumbing Code.

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Committee Statement

Committee Statement: The committee input is intended to solicit public comments on the proposed addition of criteria to address fire fighter breathing air replenishment systems, as contained in Appendix F of the UPC.

Response Message:
Committee Input No. 61-NFPA 1-2015 [ Section No. F.1.2.3 ]

F.1.2.3 API Publications.
American Petroleum Institute, 1220 L Street NW, Washington, DC 20005-4070.
"An Engineering Analysis of the Effects of Oxygenated Fuels on Marketing Vapor Recovery Equipment."
API 12R1, Setting, Maintenance, Inspection, Operation, and Repair of Tanks in Production Service.
API RP 1621, Bulk Liquid Stock Control at Retail Outlets, 2001.

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Committee Statement
Committee Statement: API references to be updated at second draft stage (NFPA 30 extracts).
Response Message:
Committee Input No. 64-NFPA 1-2015 [Section No. F.1.2.6]

F.1.2.6 ASTM Publications.
ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.
ASTM Manual on Flash Point Standards and Their Use.
ASTM E 2174, Standard Practice for On-Site Inspection of Installed Fire Stops, 2010ae1.

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Committee Statement

Committee Statement: ASTM references to be updated at second draft stage (numerous extracts).
Response Message:

Public Input No. 190-NFPA 1-2015 [Section No. F.1.2.6]
Committee Input No. 71-NFPA 1-2015 [ Section No. F.1.2.16 ]

F.1.2.16  PEI Publications.
Petroleum Equipment Institute, P.O. Box 2380, Tulsa, OK 74101-2380.

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Committee Statement

Committee Statement: PEI publications to be updated at second draft stage (NFPA 30 extracts).
Response Message:
Committee Input No. 72-NFPA 1-2015 [ Section No. F.1.2.19 ]

F.1.2.19 STI Publications.
Steel Tank Institute, 570 Oakwood Road, Lake Zurich, IL 60047.
STI RP 01-69, Recommended Practice for Control of External Corrosion of Underground or Submerged Metallic Piping Systems.
STI SP001, Standard for Inspection of Aboveground Storage Tanks
STI R 931, Double Wall AST Installation and Testing Instructions.
STI RP R011, Recommended Practice for Anchoring of Steel Underground Storage Tanks.
Keeping Water Out of Your Storage System.

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Committee Statement

Committee Statement: STI publications to be updated at second draft stage (NFPA 30/30A extracts).
Response Message:
Committee Input No. 73-NFPA 1-2015 [ Section No. F.1.2.21 ]

F.1.2.21 UL Publications.
Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.
UL Subject 2436, Outline of Investigation for Spill Containment For Stationary Lead Acid Battery Systems, 2006.
UL Subject 2728, Outline of Investigation for Pellet Fuel Burning Cooking Appliances, 2009.

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Committee Statement
Committee Statement: UL publications to be updated at second draft stage (numerous extracts).
Response Message: