# NFPA 326

# Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair

## 1999 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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**NFPA 326**

**Standard for the**

# Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair

**1999 Edition**

This edition of NFPA 326, *Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair,* was prepared by the Technical Committee on Tank Leakage and Repair Safeguards and acted on by the National Fire Protection Association, Inc., at its May Meeting held May 17–20, 1999, in Baltimore, MD. It was issued by the Standards Council on July 22, 1999, with an effective date of August 13, 1999, and supersedes all previous editions.

This edition of NFPA 326 was approved as an American National Standard on August 13, 1999.

## Origin and Development of NFPA 326

The text of this standard was originally intended as amendments to NFPA 327, *Standard Procedures for Cleaning or Safeguarding Small Tanks and Containers Without Entry,* and would have expanded the scope of NFPA 327 to those situations in which tank cleaning or repair required that personnel gain entry to the tank. Recognizing the likely conflict that would result, the committee decided that a separate standard would be desirable. An initial draft of NFPA 326, based on the existing text of NFPA 327, was developed by a task group of the committee in January 1990. The draft was revised several times over the following two years, during which time appropriate changes were also made to the text of NFPA 327.

The text of the first edition of NFPA 326 was adopted in 1993.

The text of this edition of NFPA 326 has been revised to provide safe requirements for the entry, cleaning, and repair of tanks and containers. It also provides assistance to the fire service in determining the professional qualifications necessary to perform atmospheric testing of confined spaces, with the goal of issuing hot work permits.

All parts of NFPA 327 related to this standard have been incorporated in this edition of NFPA 326. NFPA 327 was withdrawn as an NFPA standard in May 1999.

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

**Committee Scope:** This Committee shall have primary responsibility for documents on safeguarding against fire, explosion, and health hazards associated with entry, cleaning, and repair of tank systems and methods for detecting, controlling, and investigating releases that could cause these hazards.

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**NFPA 326**

**Standard for the**

# Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair

**1999 Edition**

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

Information on referenced publications can be found in Chapter 9 and Appendix B.

## FOREWORD

Extreme caution must be used when work is performed on a tank or a container that holds or has held flammable, combustible, or other hazardous substances. The same caution applies to tanks or containers that contain vapors related to the substances that are stored or were previously stored in the tank or container. Before any work is performed on a tank or a container that has held flammable, combustible, or other hazardous substances, the tank or container must be made safe. Therefore, it is important that the persons conducting the work have a thorough understanding of the following:

Characteristics of the substance that is stored or was previously stored in the tank or container

Potential health and safety risks associated with the work to be conducted

Proper procedures for safeguarding the tank or container prior to conducting the work

This standard provides the basic procedures to safeguard a tank or container prior to entry, cleaning, repair, or other activities with or without entry. The requirements for safeguarding a tank or container are described in this standard in the logical order in which work is normally conducted. Therefore, the entire standard should be reviewed before proceeding with safeguarding activities.

This standard does not contain all of the details necessary to perform the activities for safeguarding tanks and containers for entry, cleaning, or repair, and relies on other standards and procedures for this detail. A list of referenced publications that offer information related to those activities is furnished in Chapter 9 and Appendix B.

## Chapter 1 General Provisions

### 1-1 Scope.

**1-1.1*** This standard shall apply to the safeguarding of tanks or containers, operating at nominal atmospheric pressure, that contain or have contained flammable and combustible liquids or other hazardous substances and related vapors or residues.

**1-1.2*** This standard shall not apply to tank vehicles or tank cars; tanks, bunkers, or compartments on ships or barges or in a shipyard; gas plant equipment or gas distribution systems for natural or manufactured gas; or compressed and liquefied gas cylinders.

**1-1.3*** This standard shall not apply to hot tapping.

**1-1.4*** This standard shall not apply to the entry of a tank that contains an inert atmosphere.

### 1-2 Purpose.

**1-2.1** This standard shall provide minimum procedures for the following:

(a) The safe opening, entry, and cleaning of a tank that contains or has contained flammable, combustible, or other hazardous substance vapors, liquids, or solid residues.

(b) The safe removal of flammable, combustible, or other hazardous substance vapors, liquids, or solid residues from tanks or containers, and safeguarding these vessels.

**1-2.2** Such procedures shall permit repair, hot work, or other work that could create a potential fire, explosion, or other hazard.

### 1-3 Units.

**1-3.1** Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI).

**1-3.2** If a value for measurement as provided in this standard is followed by an equivalent value in other units, the first stated value is the requirement. A given equivalent value could be an approximation.

**1-4 Definitions.** For the purpose of this standard, the following terms shall have the meanings given below.

**Adjacent Spaces.** Those spaces in all directions from subject space, including points of contact, internal and external, such as decks, sumps, floating roofs, secondary containment areas, interstitial spaces, under floors, supports, tank tops, and bulkheads.

**Approved.*** Acceptable to the authority having jurisdiction.

**Attendant.** A person trained in emergency rescue procedures and who is assigned to remain on the outside of the confined space and to be in communication with those working inside.

**Authority Having Jurisdiction.*** The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

**Bonding.** The permanent joining of metal parts to form an electrically conductive path that will ensure electrical continuity and the capacity to conduct safely any current likely to be imposed.

**Combustible Gas Indicator.** An instrument that samples air and indicates whether there are any combustible vapors present.

**Combustible Liquid.** A liquid that has a closed-cup flash point at or above 37.8°C (100°F).

**Container.** A vessel, intended to contain an accumulation of hazardous substances, that is too small for human entry or has a capacity that can be effectively and safely cleaned without human entry.

**Flammable Liquid.** A liquid that has a closed-cup flash point that is below 37.8°C (100°F) and maximum vapor pressure of 2068 mm Hg (40 psia) at 37.8°C (100°F).

**Flammable Vapor.** Any substance that exists in the gaseous state at normal atmospheric temperature and pressure and that is capable of being ignited and burned when mixed with the proper proportions of air, oxygen, or other oxidizer.

**Hazardous Substance.** A substance, including combustible and flammable liquids and flammable gases, that is capable of creating harm to people, the environment, or property due to the dangers that can arise from but are not limited to toxicity, reactivity, ignitibility, or corrosivity.

**Hot Tapping.** The technique of welding and drilling on in-service tanks or containers that contain flammable, combustible, or other hazardous substances.

**Hot Work.** Any work that is a source of ignition, including open flames, cutting and welding, sparking of electrical equipment, grinding, buffing, drilling, chipping, sawing, or other similar operations that create hot metal sparks or surfaces from friction or impact.

**Inert Gas.** Any gas that is nonflammable, nonreactive, and noncontaminating.

**Inerting.** A technique by which the atmosphere in a tank or container is rendered nonignitible or nonreactive by the addition of an inert gas.

**Liquid.** Any material that has a fluidity greater than that of 300 penetration asphalt when tested in accordance with ASTM D 5, *Standard Test Method for Penetration of Bituminous Materials.* Unless otherwise specified, the term *liquid* includes both flammable and combustible liquids.

**Lower Flammable Limit (LFL).*** The concentration of a combustible material in air below which ignition will not occur.

**Oxygen Indicator.** An instrument that is capable of detecting, measuring, and monitoring concentrations of oxygen in the atmosphere.

**Purging.** The process of displacing vapors or gases from an enclosure or confined space.

**Qualified Person.*** A person who, by possession of a recognized degree, certificate, professional standing, or skill, and who, by knowledge, training, and experience, has demonstrated the ability to deal with problems relating to a particular subject matter, work, or project.

**Shall.** Indicates a mandatory requirement.

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

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

**Static Electricity.** The electrification of materials through physical contact and separation and the various effects that result from the positive and negative charges so formed, particularly where they constitute a fire or explosion hazard.

**Tank.** A stationary or portable vessel large enough to allow human entry that is intended to contain an accumulation of hazardous substances.

**Toxic Materials, Gases, or Vapors.** Any substance whose properties contain the inherent capacity to produce injury to a biological system, which is dependent on exposure, concentration, rate, method, and area of absorption.

**Toxicity.** The quality or degree a substance is harmful to humans.

**Unstable Liquid.** A liquid that, in the pure state or as commercially produced or transported, will vigorously polymerize, decompose, undergo condensation reaction, or become self-reactive under conditions of shock, pressure, or temperature.

**Vapor.** The evaporated phase of a substance that is normally a liquid at room temperature and pressure.

**Work.** Activities performed on tanks and containers in accordance with this standard including, but not limited to, safeguarding, repair, hot work, cleaning, change of service, maintenance, inspection, and transportation.

## Chapter 2 Basic Precautions

### 2-1 General.

**2-1.1** Work on tanks or containers that contain or have contained hazardous substances shall be performed only by trained personnel who understand the associated hazards. Such personnel shall be sufficiently qualified, trained, or educated to safely carry out the necessary operations.

**2-1.2** The characteristics of a hazardous substance and the atmosphere of a tank or container shall be determined. Tanks or containers shall not be worked on until information concerning the specific hazards of that substance has been obtained and safe procedures have been established.

**CAUTION**

When establishing safe procedures, the following shall be considered:

(1) All compartments of a multicompartment tank or container
(2) Annular (interstitial) space of a secondary containment-type tank or container
(3) Vapor seals
(4) Under tank floors
(5) All types of pontoons and pipe supports
(6) Any other areas where vapors or residues can be trapped

**2-1.3** An appropriate permit(s) shall be obtained, if required by the authority having jurisdiction.

**2-1.4** Work shall not begin on tanks or containers that have contained unstable liquid or reactive materials until information is obtained regarding safe cleaning procedures. Nonreactive cleaning materials shall be used where required.

**2-1.5** Prior to opening or accessing tanks or containers, any internal pressure shall be reduced to atmospheric pressure. Tank or container vapors shall be vented to a safe location.

**2-1.6** A procedure shall be available for notifying the appropriate emergency response services in the event of a fire or other emergency.

**2-1.7** A qualified person shall stipulate the requirements necessary to protect personnel working in or around the tank from exposure to hazardous substances.

**2-1.8** If hazardous chemicals are used for rinsing or cleaning a tank or container, the qualified person shall stipulate any protective equipment that is required to guard against possible injury. When using a proprietary cleaning solution, the manufacturer's instructions for safe handling and use shall be followed.

**2-2 Ignition Concerns.** This section shall apply to tanks or containers that contain or have contained flammable or combustible liquids or vapors.

**2-2.1** Prior to conducting any procedures required by this standard, the area around the tank or container shall be safeguarded from all sources of ignition. The area to be safeguarded shall be determined by the qualified person based on the potential for ignition around the tank or container. Barricades and warning signs reading "FLAMMABLE — NO SMOKING" shall be provided and placed in accordance with the requirements of the authority having jurisdiction. The area shall then be tested for the presence of flammable liquids or vapors.

**2-2.2** Any equipment that is capable of providing a source of ignition shall not be permitted within the area of the tank or container until the area around the tank or container has been tested and found to be safe.

**2-2.3** The qualified person shall determine safe procedures for working on tanks or containers that have contained nitrocellulose, pyroxylin solutions, nitrates, chlorates, perchlorates, peroxides, and other materials that contain enough oxygen to support combustion in an otherwise inerted atmosphere before operations are started.

**2-2.4** The qualified person shall determine any fire-fighting equipment to be provided in the area.

**2-2.5*** The qualified person shall stipulate the precautions needed to prevent accumulation and discharge of static electricity.

**2-2.6** Any electrical equipment used shall be suitable for Class I, Group D, Division 1 hazardous (classified) locations, as defined in NFPA 70, *National Electrical Code®*.

**2-2.7** Any equipment that could provide a source of ignition shall not be permitted within the vicinity of a tank or container that is being cleaned until the area has been tested and found to be vapor free.

## Chapter 3 Preparation for Safeguarding

### 3-1 Lockout/Tagout.

**3-1.1** All electrical circuits or other energy sources supplying power to pumps or other equipment connected to the tank or container that are a potential hazard to workers in the area of the tank or container shall be disconnected or disengaged and locked out or tagged out, or both, according to the requirements of 29 *CFR* 1910.147, "The Control of Hazardous Energy (Lockout/Tagout)."

**3-1.2** Where there is a need to test, position, or activate equipment by temporarily removing the lock or tag, or both, a procedure shall be developed and implemented to control potential hazards to the workers, and shall be authorized by the qualified person.

**3-1.3** Any removal of locks, tags, or other protective measures shall be done in accordance with 29 *CFR* 1910.147, "The Control of Hazardous Energy (Lockout/Tagout)."

**3-1.4** Lockout or tagout, or both, of equipment, systems, and processes shall be confirmed by the qualified person prior to performing work on the tank or container.

### 3-2 Removal of Flammable, Combustible, or Other Hazardous Substances, Liquids, or Gases.

**3-2.1** Prior to opening the tank or container, as much hazardous substance, water, and sediment as practical shall be removed from the tank or container using fixed piping and connections. This process shall include the removal of liquids or gases from any internal piping, traps, and standpipes that can be drained or pumped without opening the tank or container. All piping or similar conveyances for flammable, combustible, or other hazardous substances connected to the tank or container shall be drained, flushed, or isolated. Where reactivity and solubility are not a concern, water shall be permitted to be pumped into the tank or container through fixed piping or connections to float any remaining liquid from a low spot so that it can be drained or pumped from the tank or container.

**3-2.2*** Where flammable or combustible liquids or vapors are contained or have been contained in a tank or container, explosionproof, steam-driven or air-driven pumps shall be used. Pump motors and suction hoses shall be bonded to the tank or container to prevent static electricity ignition hazards.

**3-2.3** All liquids, rinseates, solid residues, and vapors that are generated as a result of these cleaning and safeguarding procedures shall be disposed of properly in accordance with the appropriate regulatory requirements.

**3-2.4** Any remaining product in the tank that is incapable of being removed as described in 3-2.1 through 3-2.3 shall remain in the tank until the tank is safeguarded and properly opened for product removal. *(See Chapter 7 for tank entry requirements.)*

### 3-3 Isolation.

**3-3.1** Prior to opening, the tank or container shall be isolated from all supply and dispensing piping systems. If the tank or container on which work is to be performed is equipped with a manifold vent, vapor recovery system, fill line, siphon assembly, or other methods of connection to other tanks or containers, the qualified person shall determine the necessary measures required to isolate that tank or container from all other tanks or containers. All piping connected to the tank that is capable of producing a hazard shall be isolated by being disconnected, plugged, double-blocked and bled, or blanked off.

**3-3.2** The vents for the tank or container on which work is to be performed shall be isolated from the vents of other tanks or containers that could still be in service. A separate, temporary vent for the tank being entered shall be provided if necessary.

**3-3.3** Valves shall not be relied on to prevent the flow of material unless a locked and tagged double-block and bleed arrangement is provided.

## Chapter 4 Testing Procedures

**4-1 General Procedures.**

**4-1.1*** To determine that an atmosphere is safe for the designated work, tests for flammable, combustible, or other hazardous substance vapors shall be made with an appropriate instrument as follows:

(1) Before entry or re-entry
(2) Before beginning alterations or repairs
(3) Before and during any welding, cutting, or heating operations
(4) Frequently during the course of the work
(5) After cleaning the interior of each tank or container to determine that the cleaning procedures have been effective
(6) After any industrial process or activity has been introduced into the tank or container that could change the atmosphere within the tank or container

**CAUTION**

Tanks or containers that have held liquids with high flash points can become hazardous during cutting and welding operations.

**4-1.2** The qualified person shall determine whether or not continued testing for flammable vapor and toxicity is required if previous testing indicates that vapor or toxicity associated with former product storage has been eliminated or is not capable of regeneration above permissible exposure levels.

**4-1.3** Persons responsible for testing shall be trained or educated in the use of the instrument, have an understanding of the significance of its readings, and be aware of its limitations.

**4-1.4*** All tests shall be conducted using a properly calibrated and adjusted instrument. The instrument shall be calibrated with the appropriate calibration gases depending on the potential hazards. The adjustment of the instrument shall be checked before each day's use. The calibration of the instrument shall be performed prior to its first use. Recalibration is required on a regular basis thereafter (depending on the manufacturer's recommendations, historical data regarding need to recalibrate, and before its use following an extended period of non-operation). The instrument shall be maintained in accordance with the manufacturer's recommendations.

**4-1.5** The number and location of sampling points shall be determined by the qualified person based on the size and configuration of the tank or container so as to provide a representative determination of the atmosphere in the tank and potential hazards of the area around the tank.

**4-2 Testing for Oxygen Content.** To determine oxygen content, a properly calibrated oxygen indicator shall be used.

**CAUTION**

When a tank or container contains an inert gas or other oxygen displacing or generating material, a combustible gas indicator will not give a correct reading. An oxygen indicator shall be used prior to testing for combustible gas in order to assure that the proper amount of oxygen is present, in accordance with the instrument's manufacturer, to provide an accurate reading of the gas or vapor being measured.

**4-3 Testing for Flammable Vapors.** To determine flammable vapor content, a properly calibrated combustible gas indicator shall be used.

**4-3.1*** All work shall be stopped immediately when the flammable vapors exceed 10 percent of the lower flammable limit. The source of the vapor release shall be located and controlled.

**4-3.2** Any equipment that could provide a source of ignition shall not be permitted within the safeguarded area of a tank or container being cleaned until the area has been tested *(see 2-2.1)* and found to be vapor free or there has been a "hot work allowed" designation *(see 6-2.4)*.

**4-3.3** During ventilation or air purging of any tank or container, the flammable vapor concentration of the effluent shall be tested as often as needed as determined by the qualified person to ensure that vented vapors will not be ignited.

**4-3.4*** If an air eductor performs the purging, the eductor shall create a vacuum that draws air through at least one tank or container opening and discharges through the opening to which it is attached. Testing for flammable vapors shall be conducted using a combustible gas indicator with its probe inserted into the probe hole provided in the side of the eductor. Testing for flammable vapor concentrations shall be performed with the eductor on and tightly secured to the tank or container fill tube.

**4-3.5*** If an air blower performs the purging, the blower shall force air into the tank or container through at least one tank or container opening discharged through another opening. Testing for flammable vapor concentrations shall be performed with a combustible gas indicator whose probe is placed in the tank or container's discharge opening. When a reading of 10 percent or less of the lower flammable limit is obtained, the air blower shall be shut off and readings taken again after a few minutes waiting time. If readings in the tank or container are taken through the fill opening, any fill tube that extends into the tank or container shall be removed prior to purging operations. The air blower shall be immediately turned on after the last test in the tank or container, and the tank's or container's vent opening shall be tested thereafter as long as ventilation continues and as often as determined necessary by the qualified person.

**4-3.6*** When testing a tank or container prior to or during hot work, any indication of flammable gas or vapor in excess of the established allowable limits shall require recleaning or further safeguarding by one of the methods described in this standard prior to performing any hot work.

**4-4* Testing for Toxic Vapors and Gases.** Testing for these substances with appropriate instrumentation shall be required to identify the level of exposure.

Guidance regarding maximum levels of these substances shall be found in the *Material Safety Data Sheet (MSDS)*; 29 *CFR* 1910.1000, Subpart Z, "Air Contaminants"; other OSHA substance-specific standards; ACGIH *Threshold Limit Values for Chemical Substances and Physical Agents;* and the NIOSH *Pocket Guide to Chemical Hazards*. The qualified person shall obtain assistance in selecting appropriate testing procedures from the appropriate regulatory agency or from a safety and health or industrial hygiene professional. This section shall not be concerned with substances that do not have adverse health effects.

## Chapter 5 Control or Removal of Vapors

**5-1 General.**

**5-1.1*** Flammable vapors in a tank or container shall be permitted to be purged with air, inert gas, water, or steam *(see Section 8-5)*. The method chosen shall be appropriate for the tank or container on which work will be performed.

**5-1.2** Flammable or combustible liquids or vapors found in spaces adjacent to or within the space containing or having contained hazardous substances shall be removed or controlled prior to proceeding. These spaces include, but are not limited to, interstitial spaces, columns, floats, hollow structures, floating roofs, pontoons, tank floors, multiple-compartment tanks or containers, vapor seals, pipe supports, and any other areas where vapors or residues can be trapped.

**5-1.3** Other hazardous substance vapors that are not flammable or combustible but have adverse human health effects shall be controlled prior to proceeding. Many of the methods identified in Section 5-1 shall apply to the control of these other hazardous substance vapors. The hazardous substances and the appropriate methods for control of these vapors shall be identified by the qualified person prior to proceeding.

**5-1.4** Prior to removing vapors from a tank or container, the appropriate regulations and applicable codes and standards shall be reviewed by the qualified person to identify any specific requirements for handling or discharging of vapors or liquids while conducting the activities described in this chapter.

**5-1.5** Where a tank is located indoors or in a confined area, such as under a building, the qualified person shall stipulate any measures to be taken to prevent the accumulation of flammable or toxic vapors within the building or confined area.

**5-2 Removal of Flammable Vapors.**

**5-2.1 Displacement with Air.**

**5-2.1.1** Where openings of sufficient size are available, air movers that do not provide an ignition source shall be attached so that air is drawn through or pumped into one opening and discharged through another opening a sufficient distance away to allow cross ventilation in the tank. If openings cannot accommodate an air mover, the tank or container shall be thoroughly purged to remove flammable vapors by introducing air that will circulate through the tank or container and be discharged to the outside. Precautions shall be taken to control or remove all ignition sources from the area since vapors can be present in the flammable range both inside the tank or container and at the point of discharge. An effective bond shall be maintained between the air mover and the tank or container being ventilated in order to reduce the chance of static electric ignition.

**5-2.1.2*** Precautions shall be taken to eliminate the possibility of static electric discharge during gas-freeing procedures.

**5-2.1.3** Where purging a tank with air, the air pressure in the tank shall not exceed the allowable maximum design pressure for the tank. To prevent excess air pressure, the vent line shall be checked to make certain it is free of blockages, obstructions, or traps. All discharges or venting to the atmosphere during the purging activity shall be at a minimum of 3.7 m (12 ft) above the ground surface and away from any areas that could contain sources of ignition.

**5-2.1.4** Displacement of the tank or container atmosphere with air shall be accomplished by one of the following methods.

(a) A negative pressure or vacuum shall be used to pull outside air into the tank or container using an eductor air mover or other equipment. When using this method, the connection between the eductor and the tank or container shall be airtight. To the extent possible, vapors shall be drawn through the tank or container to allow adequate cross ventilation and removal. All equipment shall be properly bonded to prevent the generation of static electric charges.

(b) *A positive pressure or diffused air blower shall be used to push outside air into the tank or container. If a fill opening that extends into the tank or container is used as an air supply point, the portion of the fill pipe that extends into the tank shall be removed. The air shall be supplied from a compressor or blower that has been checked for delivery of clean air that is free of flammable or toxic vapors. The air-diffusing pipe, if used, shall be properly bonded to the tank or container to prevent the generation of static electric charges.

**5-2.2* Displacement with Inert Gas.** Qualified persons shall be thoroughly familiar with the limitations and characteristics of the inert gas being used. The oxygen content shall be monitored frequently and maintained at less than 8 percent or less than 50 percent of the oxygen concentration required to support combustion, whichever is less, during the entire period that work is in progress. *(See the procedures for inerting in 5-2.2.1 through 5-2.2.7.)*

**5-2.2.1** All openings in the tank or container shall be securely closed, except for the access opening and vent.

**5-2.2.2** The inert gas shall be introduced into the tank or container through a pipe or hose that extends to a point near the bottom of the tank. This point shall be as far away as possible from the portion of the tank where repairs or other activities will be conducted in order to allow for uniform reduction of oxygen in the tank or container. The inert gas shall be introduced into the tank with consideration for the internal structure of the tank or container to allow for distribution of the inert gas throughout the tank or container. Any metal components of the equipment used to introduce the inert gas shall be bonded to the tank or container. All spaces to be inerted shall be sufficiently intact to retain the inerting medium.

**5-2.2.3** When introducing inert gas under pressure, low pressure shall be used in order to reduce the generation of static electricity.

**5-2.2.4** When carbon dioxide is used, portable carbon dioxide fire extinguishers shall not be used as the source of the inert gas. When solid carbon dioxide is used, it shall be crushed and distributed evenly over the greatest possible area for rapid sublimation.

**5-2.2.5*** The oxygen content shall be measured directly by means of an oxygen monitor. If carbon dioxide is used, the oxygen percentage shall be permitted to be calculated from the percentage of carbon dioxide in the tank or container measured by means of a carbon dioxide indicator.

**5-2.2.6*** A sign shall be posted conspicuously that warns of the hazard of inert gas and forbids entry into the tank during the inerting process.

**5-2.2.7** When work is completed and prior to entry into the tank, inerting media shall be removed to achieve an oxygen

concentration in accordance with 6-2.1. If inerting media is to remain in the tank, the tank shall be secured and a sign shall be posted in accordance with 5-2.2.6.

**5-2.3 Displacement with Water.**

**5-2.3.1** If the flammable, combustible, or other hazardous substance that was previously contained is known to be readily displaced by or easily soluble in water, then the removal of vapors shall be permitted to be accomplished by completely filling the tank or container with water and draining, repeating the operation as necessary to eliminate the flammable atmosphere.

**5-2.3.2** Removal of vapors shall also be permitted to be accomplished by completely filling the tank or container with water. If this method is used, the tank or container shall remain filled with water. Extreme care shall be taken to eliminate any vapor spaces by providing proper venting or by properly positioning the tank or container during the filling operation.

**5-2.3.3** All liquids, rinseates, solid residues, and vapors that are generated as a result of these cleaning and safeguarding procedures shall be disposed of properly in accordance with the appropriate regulatory requirements.

**CAUTION**

Water shall not be used for the removal of vapors if it will adversely react with the flammable, combustible, or other hazardous substance previously contained in the tank or container.

**5-2.4* Displacement with Steam.** Displacement shall be accomplished by introducing steam into the tank or container through a pipe inserted through an opening near the bottom of the tank or container. The pipe or connecting steam line shall be bonded to the tank or container. A manway, gauging hatch, or other sufficiently sized opening at the top of the tank or container shall remain open during the entire steaming operation to relieve pressure buildup during steaming and vacuum formation during cooling. In order to effectively remove all flammable vapors, the rate of supply of steam shall be sufficient to exceed the rate of condensation so that the whole tank or container is heated close to the boiling point of water. The tank or container shall be steamed long enough to vaporize or facilitate the removal of the residues from all portions of the walls (shell and heads). Because steam displaces oxygen, when testing the atmosphere in the tank or container with a combustible gas indicator, the tank or container shall be allowed to cool until excess water vapor has condensed, or the sample shall be drawn through a drying tube filled with calcium chloride or other drying agent *(see instrument manufacturer's recommendations)* to keep water vapor from entering the instrument.

**CAUTION**

Displacement of flammable and combustible vapors with steam is extremely hazardous and is not recommended if alternate methods are available. Prior to using steam, the qualified person shall review and approve all procedures to accomplish the task safely. Displacement with steam can generate static electric charges.

## Chapter 6 Inspection and Certification of Tanks and Containers

**6-1* General.** Once the applicable procedures in Chapters 2 through 5 have been followed, a qualified person shall inspect a tank or container and certify, in writing, that certain activities such as entry or hot work, or both, can proceed using the designations in Section 6-2. The certification shall include a description of the work to be performed and the criteria for maintaining safe conditions during the work.

**6-2 Designations.** The following designations shall be consistent with 29 *CFR* 1910.146, "Permit-Required Confined Spaces."

**6-2.1 Enter Without Restrictions.** This designation means that in the tank or space so designated the following shall apply.

(1) The oxygen content shall be at least 19.5 percent and not greater than 23.5 percent by volume.
(2) The LFL shall be less than 10 percent.
(3) Any toxic gases or vapors related to the hazardous substances, coatings in the tank, or inerting media shall be within the permissible concentrations.
(4) The residues or materials associated with the work shall not produce gases or vapors above the permissible concentrations while maintained as specified by the certification.

If any of the conditions in 6-2.1(1) through 6-2.1(4) are not met, then the space shall not be designated "enter without restrictions."

**6-2.2 No Entry Allowed.** This designation means that in the tank or space so designated, personnel shall not be authorized to enter.

**6-2.3* Enter with Restrictions.** This designation means that in the tank or space so designated, entry for work shall be contingent upon proper protective equipment, clothing, or time, as applicable, as specified by the certification.

**6-2.4 Hot Work Allowed.** This designation means that in the tank or container, attached piping, or space so designated the following shall apply.

(a) The oxygen content shall be at or below 23.5 percent by volume.

(b) The LEL shall be less than 10 percent.

(c) The residues, scale, or preservative coatings shall be removed sufficiently to prevent the spread of fire, and shall not be capable of producing an oxygen concentration greater than 23.5 percent or an atmospheric concentration of flammable vapors above 10 percent of the LEL in the presence of hot work while maintained as directed on the hot work certification.

(d) Flammable or combustible liquids or vapors found in spaces adjacent to or within the space containing or having contained hazardous substances shall be removed or controlled as specified by the hot work certification.

**6-2.5 Hot Work Not Allowed.** This designation means that in the tank or space so designated, hot work shall not be authorized by the certification.

**6-2.6 Limited Hot Work Allowed.** This designation means that in a tank, attached piping, or a space so designated the following shall apply.

(a) Tanks or spaces with residues or preservative coatings whose flash points are 82.2°C (180°F) or greater and that are free of flowing residues or coatings shall be permitted to be partially cleaned for limited hot work. The qualified person shall verify the flash points of the residues prior to issuing the certification.

(b) To prevent the spread of fire, an area shall be cleaned a sufficient distance in all directions, including below the area of the hot work, so that sparks or slag will not drop or be thrown into uncleaned areas of the space. The area shall be cleaned to meet the requirements of the standard safety designation "hot work allowed." A fire watch shall not be used in lieu of cleaning to establish a safe condition. The nature, location, and extent of the hot work shall be listed on the qualified person's certification.

(c) A portion(s) of the tank shall meet the requirements of 6-2.4. The nature or type of hot work shall be limited or restricted.

This designation shall include a statement that describes the exact location of the hot work, the nature and type of the hot work, and the limitations or restrictions of the hot work.

**6-2.7 Inerted.** This designation means that a tank, attached piping, or a space so designated shall meet the criteria specified in 5-2.2. This designation shall include a statement that describes the inerting media used and its final disposition.

## Chapter 7 Procedures for Access and Entry of Tanks

**7-1 General.**

**7-1.1** Prior to performing access or entry to a tank, flammable vapors shall be removed from the tank in accordance with the procedures outlined in Chapter 5.

**7-1.2** Testing for an atmosphere that is suitable for entry shall be conducted in accordance with Chapter 4.

**7-1.3** Any other hazards that have been identified for the material(s) previously stored shall be appropriately monitored.

**7-2 Access to Tanks.**

**7-2.1** If excavation is necessary to gain access to the tank, the access pit shall be of sufficient size to allow entry and exit from the tank and to comply with applicable U.S. Occupational Safety and Health Administration (OSHA) regulations. Personnel shall be familiar with all applicable procedures such as those established by OSHA in 29 *CFR* 1926, Subpart P, "Excavations."

**7-2.2** If a manway exists, the bolts and lid shall be removed.

**7-2.3*** If no manway exists, an opening of sufficient size to allow entry and exit from the tank and to comply with applicable OSHA regulations shall be cut into the tank. The section to be removed shall be marked, and a hole drilled with an air-driven drill at one corner of the section, using a lubricating material to reduce friction, heat, and possible sparks. After the hole is drilled, the tank atmosphere shall be tested to verify a safe atmosphere by inserting the atmosphere testing instrument probe an appropriate distance into the drilled hole.

**7-2.4** For tanks containing a flammable or combustible atmosphere, the tank access opening shall be cut using an air-driven saber saw or snipper, using a lubricating material to reduce friction and heat and to prevent possible sparks. Prior to the final cut, the plate shall be supported to prevent its falling into the tank.

**CAUTION**

The drilling and cutting operations may create heat and possible sparks on the inner surface of the tank which could result in ignition if air and flammable vapors or flammable residue are present inside the tank. The tank shall be vapor freed prior to and during cutting operations.

**7-3 Tank Entry.**

**7-3.1** Before entering tanks, personnel shall be familiar with the applicable procedures described in API 2015, *Safe Entry and Cleaning of Petroleum Storage Tanks;* API 2217A, *Guidelines for Confined Space Work in the Petroleum Industry;* ANSI Z117.1, *American National Standard Safety Requirements for Confined Spaces;* NIOSH *Criteria for a Recommended Standard for Working in Confined Spaces;* and 29 *CFR* 1910.146, "Permit-Required Confined Spaces."

**7-3.2** The vent line shall remain clear and unobstructed to allow continuous ventilation. All other lines and openings shall be plugged or capped off to keep liquids or vapors from entering the tank in accordance with the requirements of Section 3-3. If natural ventilation is inadequate to control vapors, continuous mechanical ventilation shall be used while the space is occupied.

**7-3.3** Additional precautions shall be taken if the tank bottom is perforated such that liquids or vapors that could be present in the soil or in the tank double bottom could re-enter the tank through the perforation. If this condition exists, the qualified person shall stipulate any additional precautions to be taken.

**7-4 Closing the Tank Access Opening.** If an access opening has been cut into the tank, the opening shall be closed, either temporarily or permanently, depending on the disposition of the tank.

## Chapter 8 Cleaning Tanks and Containers

**8-1 General.** The procedures outlined in Chapters 2 through 5 shall be followed to the extent applicable to the tank or container to be cleaned. If indoor cleaning is necessary, ventilation shall be sufficient to prevent the accumulation of flammable vapors inside a building.

**8-2 Purpose and Extent of Cleaning.** Where cleaning is necessary in preparation for hot work, change in service, or for other purposes, the procedures in Section 8-2 shall apply.

**8-2.1 Cleaning in Preparation for Hot Work.** Tanks or containers shall be cleaned prior to hot work to remove flammable vapors and liquid or solid residues that could release additional flammable vapors.

**8-2.2 Cleaning for Change in Service.** Tanks or containers shall be cleaned prior to a change in service if residues could contaminate or be incompatible with new material in the tank or container. Selection of a cleaning procedure shall take into consideration the chemical nature and characteristics of the residue and the characteristics of the new material to be stored in the tank.

**8-2.3 Cleaning for Other Purposes.** Other activities where tank or container cleaning can be necessary include transportation or storage, maintenance, repairs, and internal inspection. Selection of a cleaning procedure shall take into consideration the activity to be conducted, the intended use of the tank or container, and the chemical and physical properties of the material stored.

**8-3 Removal of Residual Liquids and Solids.**

**8-3.1 Accumulation.** Liquid or solid residue accumulation on the bottom of the tank shall be removed and placed in approved containers. Removal of liquid or solid residues shall include removing all visible moisture and liquids.

**8-3.2 Additional Precautions.** If it is impossible to remove all liquid or solid residues that could allow vapors to recur during work — because residues can become trapped behind heavy scale or rust and not be easily detected — additional precautions shall be taken.

**8-4 Cleaning Inspection.** After it is cleaned, the tank or container shall be inspected internally to determine the effectiveness of such cleaning. Containers or tanks that are not entered shall be visually inspected using appropriate methods. Testing according to Chapter 4 shall be performed prior to inspection to assure that no harmful vapors are present. If upon inspection it is determined that the tank or container is not clean, the cleaning procedure shall be repeated.

**8-5* Cleaning Methods.** The following methods shall be permitted to be used:

(1) Abrasive blasting
(2) Low-pressure water (e.g., triple rinse)
(3) High-pressure water blasting [e.g., 172,250 to 275,600 kPa (25,000 to 40,000 psi)]
(4) High-pressure steam
(5) Special cleaning agents (e.g., solvents, degreasers, neutralizing agents, or emulsifiers)
(6) Physical removal (e.g., vacuuming, shoveling, scraping, wiping, or absorption)

**CAUTION**

Steam cleaning, use of special cleaning agents, or high-pressure water blasting could result in the generation of static electric charges.

## Chapter 9 Referenced Publications

**9-1** The following documents or portions thereof are referenced within this standard as mandatory requirements and shall be considered part of the requirements of this standard. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this standard. Some of these mandatory documents might also be referenced in this standard for specific informational purposes and, therefore, are also listed in Appendix B.

**9-1.1 NFPA Publication.** National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 70, *National Electrical Code®*, 1999 edition.

**9-1.2 Other Publications.**

**9-1.2.1 ACGIH Publication.** American Conference of Governmental Industrial Hygienists, 1330 Kemper Meadow Drive, Cincinnati, OH 45240-1634.

ACGIH, *Threshold Limit Values for Chemical Substances and Physical Agents,* 1998.

**9-1.2.2 ANSI Publication.** American National Standards Institute, Inc., 11 West 42nd Street, 13th floor, New York, NY 10036.

ANSI Z117.1, *American National Standard Safety Requirements for Confined Spaces,* 1989.

**9-1.2.3 API Publications.** American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005.

API 2015, *Safe Entry and Cleaning of Petroleum Storage Tanks,* 1994.

API 2217A, *Guidelines for Confined Space Work in the Petroleum Industry,* 1997.

**9-1.2.4 ASTM Publication.** American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 5, *Standard Test Method for Penetration of Bituminous Materials,* 1986.

**9-1.2.5 U.S. Government Publications.** U.S. Government Printing Office, Washington, DC 20402.

NIOSH *Criteria for a Recommended Standard for Working in Confined Spaces.*

NIOSH *Pocket Guide to Chemical Hazards,* 1997.

OSHA, Title 29, *Code of Federal Regulations,* Part 1910.146, "Permit-Required Confined Spaces."

OSHA, Title 29, *Code of Federal Regulations,* Part 1910.147, "The Control of Hazardous Energy (Lockout/Tagout)."

OSHA, Title 29, *Code of Federal Regulations,* Part 1910.1000, Subpart Z, "Air Contaminants."

OSHA, Title 29, *Code of Federal Regulations,* Part 1926, Subpart P, "Excavations."

OSHA, *Material Safety Data Sheet (MSDS).*

## Appendix A Explanatory Material

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

**A-1-1.1** The procedures in this standard can apply to pressurized tanks or containers that have been taken out of service and have had their operating pressure reduced to atmospheric pressure and vented.

**A-1-1.2** Procedures for making some of the vessels listed in 1-1.2 safe are covered separately in the following publications:

(1) AGA, *Purging Principles and Practices*
(2) ANSI Z117.1, *American National Standard Safety Requirements for Confined Spaces*
(3) API 1631, *Interior Lining of Underground Storage Tanks*
(4) API 2013, *Cleaning Mobile Tanks in Flammable or Combustible Liquid Service*
(5) API 2015, *Safe Entry and Cleaning of Petroleum Storage Tanks*
(6) NFPA 306, *Standard for the Control of Gas Hazards on Vessels*

(7) NLPA 631, *Entry, Cleaning, Interior Inspection, Repair, and Lining of Underground Storage Tanks*
(8) 29 *CFR* 1910.146, "Permit-Required Confined Spaces"

**A-1-1.3** Procedures for hot tapping are covered separately in API 2201, *Procedures for Welding or Hot Tapping on Equipment in Service.*

**A-1-1.4** For information on working in an inert atmosphere, see API 2217A, *Guidelines for Work in Inert Confined Spaces in the Petroleum Industry.*

**A-1-4 Approved.** The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

**A-1-4 Authority Having Jurisdiction.** The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

**A-1-4 Lower Flammable Limit (LFL).** Also known as the lower explosive limit (LEL). Mixtures below this limit are said to be "too lean."

**A-1-4 Qualified Person.** Designation or selection of qualified persons should be done to ensure that the designations are properly applied to the inspected tank or container. Selection of qualified persons should include careful consideration of those aspects of the qualified person's education, experience, and specialized training necessary to recognize unsafe conditions, specify necessary control measures, and ensure the protection of personnel working in or near the tanks and containers within the scope of this standard.

Individuals possessing the skills and experience necessary to act as qualified persons could be employees of the tank owners, contractors, or third parties.

When selecting or reviewing the credentials of qualified persons, there are several factors that should be considered, including the following:

(1) Experience with the design, function, and operation of the tank or container types
(2) Experience with the physical, chemical, and hazardous properties of the materials previously stored
(3) Experience with the industrial activities to be performed within or on the tank or container
(4) Experience with the instrumentation and inspection techniques used in determining the testing criteria associated with the designations
(5) Familiarity with applicable industry, federal, state, and local safety standards and guidelines referenced in this standard

There are several sources of third-party experts who can successfully serve as qualified persons. Those sources are listed here in alphabetical order by designation.

(a) American Petroleum Institute Certified Aboveground Storage Tank Inspectors (recognized for expertise in aboveground storage tank design, structure, function, and operation as it relates to API 653, *Tank Inspection, Repair, Alteration, and Reconstruction*). Contact the American Petroleum Institute, Aboveground Tank Inspector Certification Program, 1220 L Street, NW, Washington, DC 20005.

(b) American Board of Industrial Hygiene Certified Industrial Hygienists (especially trained in assisting with recognition, evaluation, and control of exposure to potentially toxic materials previously stored in the vessel or used during work in the tank, and in eliminating or controlling other common workplace stresses). Contact the American Board of Industrial Hygiene, 6015 West St. Joseph, Suite 102, Lansing, MI 48917.

(c) National Fire Protection Association Certificated Marine Chemists (especially trained in dealing with fire and explosion prevention and hot work safety involving storage vessels, and in assisting with recognition, evaluation, and control of exposure to potentially toxic materials previously stored in the vessel or used during work in the tank). Contact NFPA, 1 Batterymarch Park, Quincy, MA 02269.

(d) Board Certified Safety Professionals (especially trained and experienced to create or develop procedures, processes, standards, specifications, and systems to achieve optimal control or reduction of the hazards and exposures that can harm people, property, and/or the environment). Contact the Board of Certified Safety Professionals, 208 Burwash Avenue, Savoy, IL 61874.

Others who can meet the experience requirements listed above can successfully serve as qualified persons, including state and other government certified professionals, nongovernment certified professionals, and persons approved by an authority having jurisdiction.

**A-2-2.5** For information on the accumulation and discharge of static electricity, see API 2003, *Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents,* and NFPA 77, *Recommended Practice on Static Electricity.*

**A-3-2.2** For information on static electricity ignition hazards, see API 2003, *Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents,* and NFPA 77, *Recommended Practice on Static Electricity.*

**A-4-1.1** It is recommended that continuous monitoring be performed inside the tank or container when personnel are inside.

**A-4-1.4** Fresh air can be used for 20.8 percent oxygen, 0 percent LEL, and 0 for most toxics.

**A-4-3.1** Testing the interior of a tank or container for the presence of ignitible concentrations of flammable gas or vapor is the most important phase of the cleaning procedure and

determines whether additional cleaning is needed. Most combustible gas indicators measure the concentration of vapor present as a percentage of the lower flammable limit. When a tank or container is oxygen deficient, the reading could be in error. It is essential that those using the indicator be well trained in its use and calibration and that the instrument is in good operating condition. Calibration should be done in accordance with the manufacturer's instructions.

**A-4-3.4** If an air mover is used to exhaust a tank or container, discharge from the air mover will be diluted with air used in the device. The results of any tests made at this point will be indicative only of the change in the vapor concentration inside the tank or container and will not be an accurate measurement of the actual concentration. When the desired low concentration is reached, the inside of the tank or container itself should be checked at appropriate points to determine the actual atmosphere.

**A-4-3.5** See A-4-3.4.

**A-4-3.6** API 2015, *Safe Entry and Cleaning of Petroleum Storage Tanks,* contains specific hot work requirements and safe practices that are beyond the scope and intent of this standard.

**A-4-4** Many hazardous substances stored in tanks and containers or used in cleaning or repairing them can have adverse effects on human health.

**A-5-1.1** Refer also to API 2217A, *Guidelines for Work in Inert Confined Spaces in the Petroleum Industry,* for safe practices when using inert gas to vapor free a tank or container.

**A-5-2.1.2** For more information, see API 2003, *Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents,* and NFPA 77, *Recommended Practice on Static Electricity.* See also NFPA 69, *Standard on Explosion Prevention Systems.*

**A-5-2.1.4(b)** For information on underground storage tanks, structure, see API 1604, *Closure of Underground Petroleum Storage Tanks.*

**A-5-2.2** Inerting is a means of safeguarding a tank or container by reducing the oxygen content to the point where combustion cannot take place.

Examples of inert gases commonly used are carbon dioxide, nitrogen, argon, helium, flue gases that meet the oxygen criteria, and mixtures of these gases. These gases can be obtained in cylinders and in tank trucks. Carbon dioxide can also be obtained in solid form.

For information on working in inerted spaces, see also API 2217A, *Guidelines for Work in Inert Confined Spaces in the Petroleum Industry.*

**A-5-2.2.5** The oxygen concentration can be determined using the following calculation:

$$\%O_2 = \frac{100 - \%CO_2}{100} \times 20.8$$

**A-5-2.2.6** Special precautions are necessary to work in a tank containing an inert atmosphere. These activities are beyond the scope of this standard and the qualified person should consult the appropriate references prior to allowing entry into a tank or container that contains an inert atmosphere.

**A-5-2.4** See also API 2015, *Safe Entry and Cleaning of Petroleum Storage Tanks,* and NFPA 77, *Recommended Practice on Static Electricity.*

**A-6-1** Confined space entry permits and hot work permits are examples of certifications.

**A-6-2.3** The entry should be classified as "enter with restrictions" if the following conditions exist.

(1) The oxygen content is between 19.5 and 23.5 percent by volume.
(2) Flammable vapors are between 0 and 10 percent LEL.
(3) Atmospheric concentrations of toxic substances are above the permissible exposure level (PEL) or threshold limit value (TLV) and below the immediately dangerous to life or health (IDLH) level and do not expose employees to the risk of death, incapacity, impairment of the ability to self-rescue, or acute illnesses due to health effects.

In atmospheric situations other than those in A-6-2.3(1) through A-6-2.3(3), refer to API 2015, *Safe Entry and Cleaning of Petroleum Storage Tanks,* for information on entering tanks with special precautions.

**A-7-2.3** The location of the opening in the tank can be limited by the internal structure of the tank.

**A-8-5** See Section 4.7.2 of API 2015, *Safe Entry and Cleaning of Petroleum Storage Tanks,* for appropriate safeguards.

For information on abrasive blasting, see API 2027, *Ignition Hazards Involved in Abrasive Blasting of Atmospheric Storage Tanks in Hydrocarbon Service.*

## Appendix B Referenced Publications

**B-1** The following documents or portions thereof are referenced within this standard for informational purposes only and are thus not considered part of the requirements of this standard unless also listed in Chapter 9. The edition indicated here for each reference is the current edition as of the date of the NFPA issuance of this standard.

**B-1.1 NFPA Publications.** National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 69, *Standard on Explosion Prevention Systems,* 1997 edition.

NFPA 77, *Recommended Practice on Static Electricity,* 1993 edition.

NFPA 306, *Standard for the Control of Gas Hazards on Vessels,* 1997 edition.

**B-1.2 Other Publications.**

**B-1.2.1 AGA Publication.** American Gas Association, 400 North Capitol Street, NW, Washington, DC 20001.

AGA, *Purging Principles and Practices,* 2nd edition.

**B-1.2.2 ANSI Publication.** American National Standards Institute, Inc., 11 West 42nd Street, 13th floor, New York, NY 10036.

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