

NFPA 306

Standard for the Control of Gas Hazards on Vessels

2003 Edition



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An International Codes and Standards Organization

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This edition of NFPA 306, *Standard for the Control of Gas Hazards on Vessels*, was prepared by the Technical Committee on Gas Hazards and acted on by NFPA at its May Association Technical Meeting held May 18–21, 2003, in Dallas, TX. It was issued by the Standards Council on July 18, 2003, with an effective date of August 7, 2003, and supersedes all previous editions.

This edition of NFPA 306 was approved as an American National Standard on July 18, 2003.

Origin and Development of NFPA 306

The original standard on this subject was developed by the NFPA Committee on Marine Fire Hazards in 1922 in cooperation with the NFPA Committee on Flammable Liquids. It was adopted by the Association and published as Appendix A of the “Regulations Governing Marine Fire Hazards.” Further editions with minor changes were published in 1923, 1926, and 1930. In 1947, a completely revised standard was prepared by a joint committee of the American Bureau of Shipping and the National Fire Protection Association. A revised edition was developed by the NFPA Sectional Committee on Gas Hazards, approved by the Committee on Marine Fire Protection, and adopted in 1962, amended in 1963, 1969, 1971, 1972, 1975, 1980, and 1984.

In 1988, a complete revision was prepared by the Committee. It added a new safety designation, a safe condition for vessels in lay-up, and a section on military unique vessels. Chapters 2, 3, and 4 were restructured to present the sequence for obtaining a Marine Chemist Certificate.

The 1993 edition contained amendments to the 1988 edition.

The 1997 edition, which marked the 75th year for these requirements, incorporated a new standard safety designation that reflected a common approach to an industry practice. That new designation was also supported by other changes to the document, including expanded inspection of vessel piping systems.

The 2001 edition incorporated a revised standard safety designation, and several changes that reflect safe, commonly used industry practices. Several new definitions were also included. For the first time in this document, the well-established relationship between the Marine Chemist and the competent person (as defined by U.S. Department of Labor, Occupational Safety and Health Administration regulations), and the frequency of retesting confined spaces, was provided.

The 2003 edition was completed on an expedited schedule to further revise requirements in the standard that must complement those shipyard safety requirements defined by OSHA. The Committee has clarified the standard and the Marine Chemist role by further defining the atmospheric hazards associated with safe entry and hot work as the standard’s primary focus. The standard also clarifies the intent for defining “permissible concentrations,” by stating that the most conservative value for the various exposure limits should always be used.

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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 the prevention of fire and explosion of flammable vapors in compartments or in spaces on board vessels and within shipyards and on the conditions that must exist in those compartments or spaces in order that workers can safely enter them and perform work.

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A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, Annex F lists the complete title and edition of the source documents for both mandatory and nonmandatory extracts. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

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

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard applies to vessels that carry or burn as fuel, flammable or combustible liquids. It also applies to vessels that carry or have carried flammable compressed gases, chemicals in bulk, or other products capable of creating a hazardous condition.

1.1.2 This standard describes the conditions required before a space can be entered or work can be started, continued, or started and continued on any vessel under construction, alteration, or repair, or on any vessel awaiting shipbreaking.

1.1.3 This standard applies to cold work, application or removal of protective coatings, and work involving riveting, welding, burning, or similar fire-producing operations.

1.1.4 This standard applies to vessels while in the United States, its territories and possessions, both within and outside of yards for ship construction, ship alteration, ship repair, or shipbreaking.

1.1.5 This standard applies specifically to those spaces on vessels that are subject to concentrations of combustible, flammable, and toxic liquids, vapors, gases, and chemicals

as hereinafter described. This standard is also applicable to those spaces on vessels that might not contain sufficient oxygen to permit safe entry.

1.1.6 This standard applies to land-side confined spaces, whether stationary or mobile, or other dangerous atmospheres located within the boundaries of a shipyard or ship repair facility.

1.1.7 This standard applies to Marine Chemists performing activities related to inspection and certification procedures described in this standard and consulting services connected therewith on board any vessel.

1.1.8* This standard does not apply to physical hazards of tanks and confined or enclosed spaces on a vessel or vessel sections, or in the shipyard. For the purposes of this standard, physical hazards do not include fire and explosion hazards.

1.2 Purpose. The purpose of this standard is to provide minimum requirements and conditions for use in determining that a space or area on a vessel, or in a shipyard or ship repair facility, is safe for entry or work.

1.3* Emergency Exception. Nothing in this standard shall be construed as prohibiting the Marine Chemist from allowing the immediate drydocking or emergency repair of a vessel whose safety is imperiled or which presents the potential of a serious release, discharge, or disbursement into the environment of combustible, flammable, or toxic liquids, vapors, gases, or solid chemicals (the vessel is sinking or is seriously damaged), making it impracticable to clean and to gas-free in advance. This emergency exception shall be subject to the approval of any authority having jurisdiction.

1.4* Governmental Regulations. Nothing in this standard shall be construed as superseding existing requirements of any governmental or local authority. Attention of owners, repairers, and Marine Chemists is directed to the Rules and Regulations for Tank Vessels and other rules and regulations for vessel inspection of the United States Coast Guard and the Occupational Safety and Health Administration standards (OSHA) of the United States Department of Labor, which prescribe an inspection prior to making repairs involving riveting, welding, burning, or similar fire-producing operations and prior to entering spaces where oxygen deficiency can exist. Those standards provide, under the conditions stated therein, for inspection by a Marine Chemist certificated by the National Fire Protection Association or, alternatively, for inspection by certain other persons.

Chapter 2 Referenced Publications

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

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

NFPA 312, *Standard for Fire Protection of Vessels During Construction, Repair, and Lay-Up*, 2000 edition.

2.3 Other Publications. (Reserved)

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not included, common usage of the terms shall apply.

3.2 NFPA Official Definitions.

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

3.2.2 Shall. Indicates a mandatory requirement.

3.2.3 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 or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

3.3 General Definitions.

3.3.1 Adjacent Spaces. Those spaces in all directions from subject space, including all points of contact, corners, diagonals, decks, tank tops, and bulkheads. [326:1.4]

3.3.2 Certificate. See 3.3.12, Marine Chemist's Certificate.

3.3.3 Chemical. Any compound, mixture, or solution in the form of a solid, liquid, or gas that may be hazardous by virtue of its properties other than or in addition to flammability or by virtue of the properties of compounds that might be evolved from hot work or cold work.

3.3.4 Coiled Vessels. See 3.3.17.1.

3.3.5* Combustible Material. Material made of or surfaced with wood, compressed paper, plant fibers, plastics, or other material that will ignite and burn, whether flame-proofed or not, or whether plastered or unplastered.

3.3.6* Competent Person. A person who is designated in writing by their employer in accordance with 29 CFR 1915.7.

3.3.7 Facility. A shoreside location such as a shipyard, cleaning plant, naval base, dock, pier complex, etc. that is under the ownership or control of the same party and has the same continuous shoreline under their ownership or operation.

3.3.8 Flammable Compressed Gas. Any flammable gas that has been compressed, liquefied, or compressed and liquefied for the purpose of transportation and has a Reid vapor pressure exceeding 2.76×10^5 Pa (40 psia).

3.3.9 Hollow Structures. Rudders, rudder stocks, skegs, castings, masts and booms, rails, lapped plates, and other attachments to a vessel that enclose a void space.

3.3.10 Liquids.

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

3.3.10.2 Cryogenic Liquid. See 3.5.3.

3.3.10.3* Flammable Liquid. Any liquid that has a closed-cup flash point below 37.8°C (100°F).

3.3.11 Marine Chemist. The holder of a valid Certificate issued by the National Fire Protection Association in accordance with the “Rules for the Certification and Recertification of Marine Chemists,” establishing the person's qualifications to determine whether construction, alteration, repair, or ship-breaking of vessels can be undertaken with safety. Activities of a Marine Chemist, as defined in this section, are limited to the inspection and certification procedures described in this standard and consulting services connected therewith.

3.3.12 Marine Chemist's Certificate (Certificate). A written statement issued by a Marine Chemist, stating the conditions that the Marine Chemist found at the time of inspection.

3.3.13* Secured. Closed in a manner to prevent opening or operation.

3.3.14 Shipbreaking. The breaking down of a vessel's structure for the purpose of scrapping the vessel.

3.3.15 Tank Barge. See 3.3.17.2.

3.3.16 Tank Ship. See 3.3.17.3.

3.3.17 Tank Vessel. Any vessel especially constructed or converted to carry liquid bulk cargo in tanks.

3.3.17.1 Coiled Vessels. Tank vessels using a closed system of heating coils that use thermal oil as the heating medium.

3.3.17.2 Tank Barge. Any tank vessel not equipped with a means of self-propulsion.

3.3.17.3 Tank Ship. Any tank vessel propelled by power or sail.

3.3.18 Toxic. Any material whose properties contain the inherent capacity to produce injury to a biological system, which is dependent on concentration, rate, method, and site of absorption.

3.3.19 Vessel. Includes every description of watercraft used, or capable of being used, as a means of transportation on water.

3.3.20 Visual Inspection. The physical survey of the space or compartment and surroundings in order to identify potential atmospheric and fire hazards.

3.4 Repair Classifications.

3.4.1 Cold Work. Any construction, alteration, repair, or ship-breaking that does not involve heat, fire-, or spark-producing operations.

3.4.2* Hot Work. Any activity involving riveting, welding, burning, the use of powder actuated tools or similar fire producing operations as well as grinding, drilling, abrasive blasting, or similar operations not isolated physically from any atmosphere containing more than 10 percent of the lower explosive limit of a flammable or combustible substance.

3.4.3 Work Below Deck. Work in or on enclosed spaces surrounded by shell, bulkheads, and overheads.

3.4.4 Work in the Open. Work performed from open decks or in spaces from which the overhead has been completely removed.

3.5 Flammable Cryogenic Liquid Carriers.

3.5.1* Cargo Area. That part of the ship that contains the cargo containment system, cargo pump room, and compressor room and that includes the deck areas over both the full beam and the length of the ship located above the aforementioned.

3.5.2* Cargo Containment System. The arrangement for containment of cargo including, where applicable, a primary and secondary barrier, associated insulation, and any intervening spaces and adjacent structures if necessary for the support of these elements.

3.5.3 Cryogenic Liquid. A refrigerated liquefied gas having a boiling point lower than -90°C (-130°F).

3.5.4 Hold Space. The space enclosed by the ship's structure in which a cargo containment system is situated.

3.5.5 Interbarrier Space. That space between a primary and secondary barrier, whether or not completely or partially occupied by insulation or other material.

3.5.6 Primary Barrier. The inner element designed to contain the cargo when the cargo containment system includes two boundaries.

3.5.7 Secondary Barrier. The liquid-resisting outer element of a cargo containment system designed to afford temporary containment of any envisaged leakage of liquid cargo through the primary barrier and to prevent the lowering of the temperature of the ship's structure to an unsafe level.

Chapter 4 Minimum Requirements for Issuance of Marine Chemist's Certificate and Maintenance Conditions

4.1 Determination of Conditions. The Marine Chemist shall personally determine conditions, and shall be permitted to issue a Marine Chemist's Certificate setting forth in writing that the prescribed work to a vessel can be undertaken with safety. The Marine Chemist shall, whenever possible, physically enter each compartment or space and conduct a visual inspection to the extent necessary to determine the atmospheric or fire hazards that exist. The Marine Chemist shall carry out tests within each compartment or space, ensuring compliance with the minimum applicable requirements prior to issuing a Certificate.

4.2 Procedures Prior to Issuance of a Certificate.

4.2.1 The calibration of all instruments used by the Marine Chemist shall be verified before each day's use by using a known concentration of test gas in a manner consistent with the manufacturer's recommendations. A record shall be maintained for at least three months.

4.2.2 The Marine Chemist's determinations shall include a visual inspection and tests of the spaces to be certified; and for repair or alterations involving hot work, all adjacent cargo tanks, spaces adjacent to cargo tanks, and other adjacent spaces containing or having contained flammable or combustible materials in accordance with 4.3.4(4). The determinations also shall include the following:

- (1) The three previous cargo loadings
- (2) Nature and extent of the work
- (3) Starting time and duration of the work
- (4) Tests of cargo and vent lines at manifolds and accessible openings
- (5) Verification that pipelines that could release hazardous materials into spaces that will be certified ATMOSPHERE SAFE FOR WORKERS or SAFE FOR HOT WORK are either disconnected, blanked off, or otherwise blocked by a positive method, or the valves are positioned and tagged in such a manner to prevent, or by written notice restrict, operation
- (6) Tests of cargo heating coils

4.3 Standard Safety Designations and Conditions Required. The following standard safety designations shall be used where applicable in preparing Certificates, cargo tank labels, and other references.

4.3.1* ATMOSPHERE SAFE FOR WORKERS requires that in the compartment or space so designated the following criteria shall be met at the time the permit is issued:

- (1)*The oxygen content of the atmosphere is at least 19.5 percent and not greater than 22 percent by volume.
- (2)*The concentration of flammable materials is below 10 percent of the lower explosive limit.
- (3)*Any toxic materials in the atmosphere associated with cargo, fuel, tank coatings, inerting mediums, adjacent spaces, or fumigants are within permissible concentrations at the time of the inspection.

Exception: Further testing for toxic materials shall not be required if previous testing indicates that these materials have been eliminated or are not capable of regeneration to hazardous levels while maintained as directed on the Marine Chemist's Certificate.

- (4)*The residues or materials associated with the work authorized by the Certificate are not capable of producing uncontrolled toxic materials under existing atmospheric conditions while maintained as directed on the Certificate.

4.3.1.1 If any of the conditions of 4.3.1(1), (2), (3), or (4) do not exist, then the designation NOT SAFE FOR WORKERS or ENTER WITH RESTRICTIONS shall be used.

4.3.2 NOT SAFE FOR WORKERS indicates that the compartment or space so designated shall not be entered by personnel.

4.3.3* ENTER WITH RESTRICTIONS indicates that in all spaces so designated, entry for work shall be permitted only if conditions of proper protective equipment, clothing, or time, or all of the aforementioned, as appropriate, are as specified.

4.3.4 SAFE FOR HOT WORK requires that in the compartment or space so designated the following criteria shall be met at the time the permit is issued:

- (1)*The oxygen content of the atmosphere is not greater than 22 percent by volume.
- (2)*The concentration of flammable materials in the atmosphere is less than 10 percent of the lower explosive limit.
- (3) The residues, scale, or preservative coatings are cleaned sufficiently to prevent the spread of fire and are not capable of producing a higher concentration than permitted by 4.3.4(1) or (2) under existing atmospheric conditions in the presence of hot work and while maintained as directed on the Certificate; or, in the case of the engine room or fire room bilges, or other machinery spaces, are treated in accordance with the Marine Chemist's requirements.
- (4) All adjacent spaces, containing or having contained flammable or combustible materials, are sufficiently cleaned of residues, scale, or preservative coatings to prevent the spread of fire; or are inerted; or, in the case of the ship's fuel tanks, lube tanks, or engine room or fire room bilges, or other machinery spaces, are treated in accordance with the Marine Chemist's requirements.

4.3.4.1 If any of the conditions of 4.3.4(1), (2), (3), or (4) do not exist, the designation NOT SAFE FOR HOT WORK shall be used.

4.3.5 NOT SAFE FOR HOT WORK indicates that in the compartment so designated, hot work shall not be permitted.

4.3.6 SAFE FOR LIMITED HOT WORK indicates that all of the following criteria shall be met at the time the permit is issued:

- (1) Any compartment or space so designated meets the requirements of 4.3.4(1) and 4.3.4(2) (unless inerted in accordance with 4.3.8).