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Title 29 —Labor
Subtitle B —Regulations Relating to Labor
Chapter XVII —Occupational Safety and Health Administration, Department of Labor
Part 1915 —Occupational Safety and Health Standards for Shipyard Employment

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Source: 47 FR 16986, Apr. 20, 1982, unless otherwise noted.

Subpart B—Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment

Source: 59 FR 37857, July 25, 1994, unless otherwise noted.

§ 1915.11 Scope, application and definitions applicable to this subpart.

(a) ***Scope and application.*** This subpart applies to work in confined and enclosed spaces and other dangerous atmospheres in shipyard employment, including vessels, vessel sections, and on land-side operations regardless of geographic location.

(b) ***Definitions applicable to this subpart. Adjacent spaces*** means those spaces bordering a subject space in all directions, including all points of contact, corners, diagonals, decks, tank tops, and bulkheads.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, or designated representative.

Certified Industrial Hygienist (CIH) means an industrial hygienist who is certified by the American Board of Industrial Hygiene.

Coast Guard authorized person means an individual who meets the requirement of appendix B to subpart B of this part 1915 for tank vessels, for passenger vessels, and for cargo and miscellaneous vessels.

Dangerous atmosphere means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (i.e., escape unaided from a confined or enclosed space), injury, or acute illness.

Director means the Director of the National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designated representative.

Enter with Restrictions denotes a space where entry for work is permitted only if engineering controls, personal protective equipment, clothing, and time limitations are as specified by the Marine Chemist, Certified Industrial Hygienist, or the shipyard competent person.

Entry means the action by which a person passes through an opening into a space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

Hot work means any activity involving riveting, welding, burning, the use of powder-actuated tools or similar fire-producing operations. Grinding, drilling, abrasive blasting, or similar spark-producing operations are also considered hot work except when such operations are isolated physically from any atmosphere containing more than 10 percent of the lower explosive limit of a flammable or combustible substance.

Immediately dangerous to life or health (IDLH) means an atmosphere that poses an immediate threat to life or that is likely to result in acute or immediate severe health effects.

Inert or inerted atmosphere means an atmospheric condition where:

(1) The oxygen content of the atmosphere in the space is maintained at a level equal to or less than 8.0 percent by volume or at a level at or below 50 percent of the amount required to support combustion, whichever is less; or

(2) The space is flooded with water and the vapor concentration of flammable or combustible materials in the free space atmosphere above the water line is less than 10 percent of the lower explosive limit for the flammable or combustible material.

Labeled means identified with a sign, placard, or other form of written communication, including pictograms, that provides information on the status or condition of the work space to which it is attached.

Lower explosive limit (LEL) means the minimum concentration of vapor in air below which propagation of a flame does not occur in the presence of an ignition source.

Marine Chemist means an individual who possesses a current Marine Chemist Certificate issued by the National Fire Protection Association.

Not Safe for Hot Work denotes a space where hot work may not be performed because the conditions do not meet the criteria for Safe for Hot Work.

Nationally Recognized Testing Laboratory (NRTL) means an organization recognized by OSHA, in accordance with appendix A of 29 CFR 1910.7, which tests for safety and lists or labels or accepts equipment and materials that meet all the criteria found in § 1910.7(b)(1) through (b)(4)(ii).

Not Safe for Workers denotes a space where an employee may not enter because the conditions do not meet the criteria for Safe for Workers.

Oxygen-deficient atmosphere means an atmosphere having an oxygen concentration of less than 19.5 percent by volume.

Oxygen-enriched atmosphere means an atmosphere that contains 22.0 percent or more oxygen by volume.

Safe for Hot Work denotes a space that meets all of the following criteria:

(1) The oxygen content of the atmosphere does not exceed 22.0 percent by volume;

(2) The concentration of flammable vapors in the atmosphere is less than 10 percent of the lower explosive limit;

(3) The residues or materials in the space are not capable of producing a higher concentration than permitted in paragraph (1) or (2) of the above, under existing atmospheric conditions in the presence of hot work and while maintained as directed by the Marine Chemist or competent person, and

(4) All adjacent spaces have been cleaned, or inerted, or treated sufficiently to prevent the spread of fire.

Safe for Workers denotes a space that meets the following criteria:

(1) The oxygen content of the atmosphere is at least 19.5 percent and below 22 percent by volume;

(2) The concentration of flammable vapors is below 10 percent of the lower explosive limit (LEL);

(3) Any toxic materials in the atmosphere associated with cargo, fuel, tank coatings, or inerting media are within permissible concentrations at the time of the inspection; and

(4) Any residues or materials associated with the work authorized by the Marine Chemist, Certified Industrial Hygienist, or competent person will not produce uncontrolled release of toxic materials under existing atmospheric conditions while maintained as directed.

Space means an area on a vessel or vessel section or within a shipyard such as, but not limited to: cargo tanks or holds; pump or engine rooms; storage lockers; tanks containing flammable or combustible liquids, gases, or solids; rooms within buildings; crawl spaces; tunnels; or accessways. The atmosphere within a space is the entire area within its bounds.

Upper explosive limit (UEL) means the maximum concentration of flammable vapor in air above which propagation of flame does not occur on contact with a source of ignition.

Vessel section means a sub-assembly, module, or other component of a vessel being built, repaired, or broken.

Visual inspection means the physical survey of the space, its surroundings and contents to identify hazards such as, but not limited to, restricted accessibility, residues, unguarded machinery, and piping or electrical systems.

§ 1915.12 Precautions and the order of testing before entering confined and enclosed spaces and

other dangerous atmospheres.

The employer shall ensure that atmosphereic testing is performed in the following sequence: oxygen content, flammability, toxicity.

(a) ***Oxygen content.***

(1) The employer shall ensure that the following spaces are visually inspected and tested by a competent person to determine the atmosphere's oxygen content prior to initial entry into the space by an employee:

(i) Spaces that have been sealed, such as, but not limited to, spaces that have been coated and closed up, and non-ventilated spaces that have been freshly painted;

(ii) Spaces and adjacent spaces that contain or have contained combustible or flammable liquids or gases;

(iii) Spaces and adjacent spaces that contain or have contained liquids, gases, or solids that are toxic, corrosive, or irritant;

(iv) Spaces and adjacent spaces that have been fumigated; and

(v) Spaces containing materials or residues of materials that create an oxygen-deficient atmosphere.

(2) If the space to be entered contains an oxygen deficient atmosphere, the space shall be labeled “Not Safe for Workers” or, if oxygen-enriched, “Not Safe for Workers—Not Safe for Hot Work.” If an oxygen-deficient or oxygen-enriched atmosphere is found, ventilation shall be provided at volumes and flow rates sufficient to ensure that the oxygen content is maintained at or above 19.5 percent and below 22.0 percent by volume. The warning label may be removed when the oxygen content is equal to or greater than 19.5 and less than 22.0 percent by volume.

(3) An employee may not enter a space where the oxygen content, by volume, is below 19.5 percent or above 22.0 percent. Exception: An employee may enter for emergency rescue or for a short duration for installation of ventilation equipment necessary to start work in the space provided:

(i) The atmosphere in the space is monitored for oxygen content, by volume, continuously; and

(ii) Respiratory protection and other appropriate personal protective equipment and clothing are provided in accordance with subpart I of this part.

Note to paragraph (a): Other provisions for work in IDLH atmospheres are located in subpart I of this part.

(b) ***Flammable atmospheres.***

(1) The employer shall ensure that spaces and adjacent spaces that contain or have contained combustible or flammable liquids or gases are:

(i) Inspected visually by the competent person to determine the presence of combustible or flammable liquids; and

(ii) Tested by a competent person prior to entry by an employee to determine the concentration of flammable vapors and gases within the space.

(2) If the concentration of flammable vapors or gases in the space to be entered is equal to or greater than 10 percent of the lower explosive limit, the space shall be labeled “Not Safe for Workers” and “Not Safe for Hot Work.” Ventilation shall be provided at volumes and flow rates sufficient to ensure that the concentration of flammable vapors is maintained below 10 percent of the lower explosive limit. The warning labels may be removed when the concentration of flammable vapors is below 10 percent of the lower explosive limit.

(3) An employee may not enter a space where the concentration of flammable vapors or gases is equal to or greater than 10 percent of the lower explosive limit. Exception: An employee may enter for emergency rescue or for a short duration for installation of ventilation equipment necessary to start work in the space, provided:

(i) No ignition sources are present;

(ii) The atmosphere in the space is monitored continuously;

(iii) Atmospheres at or above the upper explosive limit are maintained; and

(iv) Respiratory protection and other appropriate personal protective equipment and clothing are provided in accordance with subpart I of this part.

Note 1 to paragraph (b): Additional provisions for work in IDLH atmospheres are located in subpart I of this part.

Note 2 to paragraph (b): Additional provisions for work in spaces containing a flammable substance which also has a permissible exposure limit, are located in subpart Z of 29 CFR part 1915, and § 1915.12(c).

(c) ***Toxic, corrosive, irritant or fumigated atmospheres and residues.***

(1) The employer shall ensure that spaces or adjacent spaces that contain or have contained liquids, gases, or solids that are toxic, corrosive or irritant are:

(i) Inspected visually by the competent person to determine the presence of toxic, corrosive, or irritant residue contaminants; and

(ii) Tested by a competent person prior to initial entry by an employee to determine the air concentration of toxics, corrosives, or irritants within the space.

(2) If a space contains an air concentration of a material which exceeds a part 1915 subpart Z permissible exposure limit (PEL) or is IDLH, the space shall be labeled “Not Safe for Workers.” Ventilation shall be provided at volumes and flow rates which will ensure that air concentrations are maintained within the PEL or, in the case of contaminants for which there is no established PEL, below the IDLH. The warning label may be removed when the concentration of contaminants is maintained within the PEL or below IDLH level.

(3) If a space cannot be ventilated to within the PELs or is IDLH, a Marine Chemist or CIH must re-test until the space can be certified “Enter with Restrictions” or “Safe for Workers.”

(4) An employee may not enter a space whose atmosphere exceeds a PEL or is IDLH. Exception: An employee may enter for emergency rescue, or for a short duration for installation of ventilation equipment provided:

(i) The atmosphere in the space is monitored continuously;

(ii) Respiratory protection and other necessary and appropriate personal protective equipment and clothing are provided in accordance with subpart I of this part.

Note to paragraph (c): Other provisions for work in IDLH atmospheres are located in subpart I of this part.

(d) ***Training of employees entering confined and enclosed spaces or other dangerous atmospheres.***

(1) The employer shall ensure that each employee that enters a confined or enclosed space and other areas with dangerous atmospheres is trained to perform all required duties safely.

(2) The employer shall ensure that each employee who enters a confined space, enclosed space, or other areas with dangerous atmospheres is trained to:

(i) Recognize the characteristics of the confined space;

(ii) Anticipate and be aware of the hazards that may be faced during entry;

(iii) Recognize the adverse health effects that may be caused by the exposure to a hazard;

(iv) Understand the physical signs and reactions related to exposures to such hazards;

(v) Know what personal protective equipment is needed for safe entry into and exit from the space;

(vi) Use personal protective equipment; and

(vii) Where necessary, be aware of the presence and proper use of barriers that may be needed to protect an entrant from hazards.

(3) The employer shall ensure that each entrant into confined or enclosed spaces or other dangerous atmospheres is trained to exit the space or dangerous atmosphere whenever:

(i) The employer or his or her representative orders evacuation;

(ii) An evacuation signal such as an alarm is activated ; or

(iii) The entrant perceives that he or she is in danger.

(4) The employer shall provide each employee with training:

(i) Before the entrant begins work addressed by this section; and

(ii) Whenever there is a change in operations or in an employee's duties that presents a hazard about which the employee has not previously been trained.

(5) The employer shall certify that the training required by paragraphs (d)(1) through (d)(4) of this section has been accomplished.

(i) The certification shall contain the employee's name, the name of the certifier, and the date(s) of the certification.

(ii) The certification shall be available for inspection by the Assistant Secretary, the Director, employees, and their representatives.

(e) ***Rescue teams.*** The employer shall either establish a shipyard rescue team or arrange for an outside rescue team which will respond promptly to a request for rescue service.

(1) Shipyard rescue teams shall meet the following criteria:

(i) Each employee assigned to the shipyard team shall be provided with and trained to use the personal protective equipment he or she will need, including respirators and any rescue equipment necessary for making rescues from confined and enclosed spaces and other dangerous atmospheres.

(ii) Each employee assigned to the shipyard rescue team shall be trained to perform his or her rescue functions including confined and enclosed and other dangerous atmosphere entry.

(iii) Shipyard rescue teams shall practice their skills at least once every 12 months. Practice drills shall include the use of mannequins and rescue equipment during simulated rescue operations involving physical facilities that approximate closely those facilities from which rescue may be needed.

Note to paragraph (e)(1)(iii): If the team performs an actual rescue during the 12 month period, an additional practice drill for that type of rescue is not required.

(iv) At least one person on each rescue team shall maintain current certification in basic first aid which includes maintenance of an airway, control of bleeding, maintenance of circulation and cardiopulmonary resuscitation (CPR) skills.

(2) The employer shall inform outside rescue teams of the hazards that the team may encounter when called to perform confined and enclosed space or other dangerous atmosphere rescue at the employer's facility so that the rescue team can be trained and equipped.

Note to paragraph (e): The criteria for in-house rescue, listed in paragraph (e)(1) can be used by the employer in evaluating outside rescue services.

(f) ***Exchanging hazard information between employers.*** Each employer whose employees work in confined and enclosed spaces or other dangerous atmospheres shall ensure that all available information on the hazards, safety rules, and emergency procedures concerning those spaces and atmospheres is exchanged with any other employer whose employees may enter the same spaces.

[59 FR 37857, July 25, 1994, as amended at 60 FR 14219, Mar. 16, 1995]

§ 1915.13 Cleaning and other cold work.

(a) ***Locations covered by this section.*** The employer shall ensure that manual cleaning and other cold work are not performed in the following spaces unless the conditions of paragraph (b) of this section have been met:

(1) Spaces containing or having last contained bulk quantities of combustible or flammable liquids or gases; and

(2) Spaces containing or having last contained bulk quantities of liquids, gases or solids that are toxic, corrosive or irritating.

(b) ***Requirements for performing cleaning or cold work.***

(1) Liquid residues of hazardous materials shall be removed from work spaces as thoroughly as practicable before employees start cleaning operations or cold work in a space. Special care shall be taken to prevent the spilling or the draining of these materials into the water surrounding the vessel, or for shore-side operations, onto the surrounding work area.

(2) Testing shall be conducted by a competent person to determine the concentration of flammable, combustible, toxic, corrosive, or irritant vapors within the space prior to the beginning of cleaning or cold work.

(3) Continuous ventilation shall be provided at volumes and flow rates sufficient to ensure that the concentration(s) of:

(i) Flammable vapor is maintained below 10 percent of the lower explosive limit; and

> Note to paragraph (b)(3)(i): Spaces containing highly volatile residues may require additional ventilation to keep the concentration of flammable vapors below 10 percent of the lower explosive limit and within the permissible exposure limit.

(ii) Toxic, corrosive, or irritant vapors are maintained within the permissible exposure limits and below IDLH levels.

(4) Testing shall be conducted by the competent person as often as necessary during cleaning or cold work to assure that air concentrations are below 10 percent of the lower explosive limit and within the PELs and below IDLH levels. Factors such as, but not limited to, temperature, volatility of the residues and other existing conditions in and about the spaces are to be considered in determining the frequency of testing necessary to assure a safe atmosphere.

> Note to paragraph (b)(4): See appendix A for additional information on frequency of testing.

(5) Spills or other releases of flammable, combustible, toxic, corrosive, and irritant materials shall be cleaned up as work progresses.

(6) An employee may not enter a confined or enclosed space or other dangerous atmosphere if the concentration of flammable or combustible vapors in work spaces exceeds 10 percent of the lower explosive limit. Exception: An employee may enter for emergency rescue or for a short duration for installation of ventilation equipment provided:

(i) No ignition sources are present;

(ii) The atmosphere in the space is monitored continuously;

(iii) The atmosphere in the space is maintained above the upper explosive limit; and

(iv) Respiratory protection, personal protective equipment, and clothing are provided in accordance with subpart I of this part.

Note to paragraph (b)(6): Other provisions for work in IDLH and other dangerous atmospheres are located in subpart I of this part.

(7) A competent person shall test ventilation discharge areas and other areas where discharged vapors may collect to determine if vapors discharged from the spaces being ventilated are accumulating in concentrations hazardous to employees.

(8) If the tests required in paragraph (b)(7) of this section indicate that concentrations of exhaust vapors that are hazardous to employees are accumulating, all work in the contaminated area shall be stopped until the vapors have dissipated or been removed.

(9) Only explosion-proof, self-contained portable lamps, or other electric equipment approved by a National Recognized Testing Laboratory (NRTL) for the hazardous location shall be used in spaces described in paragraph (a) of this section until such spaces have been certified as "Safe for Workers."

Note to paragraph (b)(9): Battery-fed, portable lamps or other electric equipment bearing the approval of a NRTL for the class, and division of the location in which they are used are deemed to meet the requirements of this paragraph.

(10) The employer shall prominently post signs that prohibit sources of ignition within or near a space that has contained flammable or combustible liquids or gases in bulk quantities:

(i) At the entrance to those spaces;

(ii) In adjacent spaces; and

(iii) In the open area adjacent to those spaces.

(11) All air moving equipment and its component parts, including duct work, capable of generating a static electric discharge of sufficient energy to create a source of ignition, shall be bonded electrically to the structure of a vessel or vessel section or, in the case of land-side spaces, grounded to prevent an electric discharge in the space.

(12) Fans shall have non-sparking blades, and portable air ducts shall be of non-sparking materials.

Note to paragraph (b): See § 1915.12(c) of this part and applicable requirements of 29 CFR part 1915, subpart Z for other provisions affecting cleaning and cold work.

§ 1915.14 Hot work.

(a) ***Hot work requiring testing by a Marine Chemist or Coast Guard authorized person.***

(1) The employer shall ensure that hot work is not performed in or on any of the following confined and enclosed spaces and other dangerous atmospheres, boundaries of spaces or pipelines until the work area has been tested and certified by a Marine Chemist or a U.S. Coast Guard authorized person as "Safe for Hot Work":

(i) Within, on, or immediately adjacent to spaces that contain or have contained combustible or flammable liquids or gases.

(ii) Within, on, or immediately adjacent to fuel tanks that contain or have last contained fuel; and

(iii) On pipelines, heating coils, pump fittings or other accessories connected to spaces that contain or have last contained fuel.

(iv) Exception: On dry cargo, miscellaneous and passenger vessels and in the landside operations within spaces which meet the standards for oxygen, flammability and toxicity in § 1915.12, but are adjacent to spaces containing flammable gases or liquids, with a flash point below 150 °F (65.6 °C) when the distance between such spaces and the work is 25 feet (7.62 m) or greater.

Note to paragraph (a)(1)(iv): For flammable liquids with flash points above 150 °F (65.6 °C), see paragraph (b) of this section.

(2) The certificate issued by the Marine Chemist or Coast Guard authorized person shall be posted in the immediate vicinity of the affected operations while they are in progress and kept on file for a period of at least three months from the date of the completion of the operation for which the certificate was generated.

(b) ***Hot work requiring testing by a competent person.***

(1) Hot work is not permitted in or on the following spaces or adjacent spaces or other dangerous atmospheres until they have been tested by a competent person and determined to contain no concentrations of flammable vapors equal to or greater than 10 percent of the lower explosive limit:

(i) Dry cargo holds,

(ii) The bilges,

(iii) The engine room and boiler spaces for which a Marine Chemist or a Coast Guard authorized person certificate is not required under paragraph (a)(1)(i) of this section.

(iv) Vessels and vessel sections for which a Marine Chemist or Coast Guard authorized person certificate is not required under paragraph (a)(1)(iv) of this section.

(v) Land-side confined and enclosed spaces or other dangerous atmospheres not covered by paragraph (a)(1) of this section.

(2) If the concentration of flammable vapors or gases is equal to or greater than 10 percent of the lower explosive limit in the space or an adjacent space where the hot work is to be done, then the space shall be labeled “Not Safe for Hot Work” and ventilation shall be provided at volumes and flow rates sufficient to ensure that the concentration of flammable vapors or gases is below 10 percent by volume of the lower explosive limit. The warning label may be removed when the concentration of flammable vapors and gases are below 10 percent lower explosive limit.

Note to § 1915.14: See appendix A of this subpart for additional information relevant to performing hot work safely.

[59 FR 37857, July 25, 1994, as amended at 60 FR 14219, Mar. 16, 1995; 67 FR 44541, July 3, 2002]

§ 1915.15 Maintenance of safe conditions.

(a) ***Preventing hazardous materials from entering.*** Pipelines that could carry hazardous materials into spaces that have been certified "Safe for Workers" or "Safe for Hot Work" shall be disconnected, blanked off, or otherwise blocked by a positive method to prevent hazardous materials from being discharged into the space.

(b) ***Alteration of existing conditions.*** When a change that could alter conditions within a tested confined or enclosed space or other dangerous atmosphere occurs, work in the affected space or area shall be stopped. Work may not be resumed until the affected space or area is visually inspected and retested and found to comply with §§ 1915.12, 1915.13, and 1915.14 of this part, as applicable.

Note to paragraph (b): Examples of changes that would warrant the stoppage of work include: The opening of manholes or other closures or the adjusting of a valve regulating the flow of hazardous materials.

(c) ***Tests to maintain the conditions of a Marine Chemist's or Coast Guard authorized person's certificates.*** A competent person shall visually inspect and test each space certified as "Safe for Workers" or "Safe for Hot Work," as often as necessary to ensure that atmospheric conditions within that space are maintained within the conditions established by the certificate after the certificate has been issued.

(d) ***Change in the conditions of a Marine Chemist's or Coast Guard authorized person's certificate.*** If a competent person finds that the atmospheric conditions within a certified space fail to meet the applicable requirements of §§ 1915.12, 1915.13, and 1915.14 of this part, work in the certified space shall be stopped and may not be resumed until the space has been retested by a Marine Chemist or Coast Guard authorized person and a new certificate issued in accordance with § 1915.14(a).

(e) ***Tests to maintain a competent person's findings.*** After a competent person has conducted a visual inspection and tests required in §§ 1915.12, 1915.13, and 1915.14 of this part and determined a space to be safe for an employee to enter, he or she shall continue to test and visually inspect spaces as often as necessary to ensure that the required atmospheric conditions within the tested space are maintained."

(f) ***Changes in conditions determined by competent person's findings.*** After the competent person has determined initially that a space is safe for an employee to enter and he or she finds subsequently that the conditions within the tested space fail to meet the requirements of §§ 1915.12, 1915.13, and 1915.14, of this part, as applicable, work shall be stopped until the conditions in the tested space are corrected to comply with §§ 1915.12, 1915.13, and 1915.14, as applicable.

[59 FR 37857, July 25, 1994, as amended at 60 FR 14219, Mar. 16, 1995; 67 FR 44541, July 3, 2002]

§ 1915.16 Warning signs and labels.

(a) ***Employee comprehension of signs and labels.*** The Employer shall ensure that each sign or label posted to comply with the requirements of this subpart is presented in a manner that can be perceived and understood by all employees.

(b) ***Posting of large work areas.*** A warning sign or label required by paragraph (a) of this section need not be posted at an individual tank, compartment or work space within a work area if the entire work area has been tested and certified: not safe for workers, not safe for hot work, and if the sign or label to this effect is posted conspicuously at each means of access to the work area.

Appendix A to Subpart B of Part 1915—Compliance Assistance Guidelines for Confined and Enclosed Spaces and Other Dangerous Atmospheres

This appendix is a non-mandatory set of guidelines provided to assist employers in complying with the requirements of this subpart. This appendix neither creates additional obligations nor detracts from obligations otherwise contained in the standard. It is intended to provide explanatory information and educational material to employers and employees to foster understanding of, and compliance with, the standard.

Sections 1915.11 through 1915.16. These standards are minimum safety standards for entering and working safely in vessel tanks and compartments.

Section 1915.11(b) Definition of "Hot work." There are several instances in which circumstances do not necessitate that grinding, drilling, abrasive blasting be regarded as hot work. Some examples are:

1. Abrasive blasting of the external surface of the vessel (the hull) for paint preparation does not necessitate pumping and cleaning the tanks of the vessel.
2. Prior to hot work on any hollow structure, the void space should be tested and appropriate precautions taken.

Section 1915.11(b) Definition of "Lower explosive limit." The terms lower flammable limit (LFL) and lower explosive limit (LEL) are used interchangeably in fire science literature.

Section 1915.11(b) Definition of "Upper explosive limit." The terms upper flammable limit (UFL) and upper explosive limit (UEL) are used interchangeably in fire science literature.

Section 1915.12(a)(3). After a tank has been properly washed and ventilated, the tank should contain 20.8 percent oxygen by volume. This is the same amount found in our normal atmosphere at sea level. However, it is possible that the oxygen content will be lower. When this is the case, the reasons for this deficiency should be determined and corrective action taken.

An oxygen content of 19.5 percent can support life and is adequate for entry. However, any oxygen level greater than 20.8 percent by volume should alert the competent person to look for the cause of the oxygen-enriched atmosphere and correct it prior to entry. In addition, any oxygen level lower than 19.5 percent level should also alert the competent person to look for the cause of the oxygen-deficiency and correct it prior to entry.

Section 1915.12(b)(3) Flammable atmospheres. Atmospheres with a concentration of flammable vapors at or above 10 percent of the lower explosive limit (LEL) are considered hazardous when located in confined spaces. However, atmospheres with flammable vapors below 10 percent of the LEL are not necessarily safe.

Such atmospheres are too lean to burn. Nevertheless, when a space contains or produces measurable flammable vapors below the 10 percent LEL, it might indicate that flammable vapors are being released or introduced into the space and could present a hazard in time. Therefore, the cause of the vapors should be investigated and, if possible, eliminated prior to entry.

Some situations that have produced measurable concentrations of flammable vapors that could exceed 10 percent of the LEL in time are:

1. Pipelines that should have been blanked or disconnected have opened, allowing product into the space.

2. The vessel may have shifted, allowing product not previously cleaned and removed during washing to move into other areas of the vessel.

3. Residues may be producing the atmosphere by releasing flammable vapor.

Section 1915.12(b)(6) Flammable atmospheres that are toxic. An atmosphere with a measurable concentration of a flammable substance below 10 percent of the LEL may be above the OSHA permissible exposure limit for that substance. In that case, refer to § 1915.12(c) (2), (3), and (4).

Sections 1915.13(b)(4), 1915.15(c), and 1915.15(e). The frequency with which a tank is monitored to determine if atmospheric conditions are being maintained is a function of several factors that are discussed below:

1. ***Temperature.*** Higher temperatures will cause a combustible or flammable liquid to vaporize at a faster rate than lower temperatures. This is important since hotter days may cause tank residues to produce more vapors and that may result in the vapors exceeding 10 percent of the LEL or an overexposure to toxic contaminants.

2. ***Work in the tank.*** Any activity in the tank could change the atmospheric conditions in that tank. Oxygen from a leaking oxyfuel hose or torch could result in an oxygen-enriched atmosphere that would more easily propagate a flame. Some welding operations use inert gas, and leaks can result in an oxygen-deficient atmosphere. Manual tank cleaning with high pressure spray devices can stir up residues and result in exposures to toxic contaminants. Simple cleaning or mucking out, where employees walk through and shovel residues and sludge, can create a change in atmospheric conditions.

3. ***Period of time elapsed.*** If a period of time has elapsed since a Marine Chemist or Coast Guard authorized person has certified a tank as safe, the atmospheric condition should be rechecked by the competent person prior to entry and starting work.

4. ***Unattended tanks or spaces.*** When a tank or space has been tested and declared safe, then subsequently left unattended for a period of time, it should be retested prior to entry and starting work. For example, when barges are left unattended at night, unidentified products from another barge are sometimes dumped into their empty tanks. Since this would result in a changed atmosphere, the tanks should be retested prior to entry and starting work.

5. ***Work break.*** When workers take a break or leave at the end of the shift, equipment sometimes is inadvertently left in the tanks. At lunch or work breaks and at the end of the shift are the times when it is most likely someone will leave a burning or cutting torch in the tank, perhaps turned on and leaking oxygen or an inert gas. Since the former can produce an oxygen-enriched atmosphere, and the latter an oxygen-deficient atmosphere, tanks should be checked for equipment left behind, and atmosphere, monitored if necessary prior to re-entering and resuming work. In an oxygen-enriched atmosphere, the flammable range is severely broadened. This means that an oxygen-enriched atmosphere can promote very rapid burning.

6. ***Ballasting or trimming.*** Changing the position of the ballast, or trimming or in any way moving the vessel so as to expose cargo that had been previously trapped, can produce a change in the atmosphere of the tank. The atmosphere should be retested after any such move and prior to entry or work.

Section 1915.14 (a) and

(b) ***Hot work.*** This is a reminder that other sections of the OSHA shipyard safety and health standards in part 1915 should be reviewed prior to starting any hot work. Most notably, subpart D, Welding, Cutting and Heating, places additional restrictions on hot work. The requirements of §§ 1915.51 and 1915.53 must be met before hot work is begun on any metal that is toxic or is covered by a preservative coating respectively; the requirements of § 1915.54 must be met before welding, cutting, or heating is begun on any hollow containers or structures not covered by § 1915.12.

Section 1915.12(a)(2). During hot work, more than 20.8 percent oxygen by volume can be unsafe since it extends the normal flammable range. The standard permits the oxygen level to reach 22 percent by volume in order to account for instrument error. However, the cause of excess oxygen should be investigated and the source removed.

Section 1915.16(b). If the entire vessel has been found to be in the same condition, then employers shall be considered to be in compliance with this requirement when signs using appropriate warning language in accordance with § 1915.16(a) are posted at the gangway and at all other means of access to the vessel.

[47 FR 16986, Apr. 20, 1982, as amended at 67 FR 44541, July 3, 2002; 76 FR 33609, June 8, 2011]

Appendix B to Subpart B of Part 1915—Reprint of U.S. Coast Guard Regulations Referenced in Subpart B, for Determination of Coast Guard Authorized Persons

This appendix provides a complete reprint of U.S. Coast Guard regulations as of October 1, 1993, referenced in subpart B for purposes of determining who is a Coast Guard authorized person.

1. Title 46 CFR 35.01–1 (a) through (c) covering hot work on tank vessels reads as follows:

(a) The provisions of "Standard for the Control of Gas Hazards on Vessels to be Repaired," NFPA No. 306, published by National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269, shall be used as a guide in conducting the inspections and issuance of certificates required by this section.

(b) Until an inspection has been made to determine that such operation can be undertaken with safety, no alterations, repairs, or other such operations involving riveting, welding, burning, or like fire-producing actions shall be made:

(1) Within or on the boundaries of cargo tanks that have been used to carry flammable or combustible liquid or chemicals in bulk, or within spaces adjacent to such cargo tanks; or

(2) Within or on the boundaries of fuel tanks; or

(3) To pipe lines, heating coils, pumps, fittings, or other appurtenances connected to such cargo or fuel tanks.

(c) Such inspections shall be made and evidenced as follows:

(1) In ports or places in the United States or its territories and possessions, the inspection shall be made by a Marine Chemist certificated by the National Fire Protection Association; however, if the services of such certified Marine Chemists are not reasonably available, the Officer in Charge, Marine Inspection, upon the recommendation of the vessel owner and his contractor or their representative, shall select a person who, in the case of an individual vessel, shall be authorized to make such inspection. If the inspection indicates that such operations can be undertaken with safety, a certificate setting forth the fact in writing and qualified as may be

required, shall be issued by the certified Marine Chemist or the authorized person before the work is started. Such qualifications shall include any requirements as may be deemed necessary to maintain, insofar as can reasonably be done, the safe conditions in the spaces certified, throughout the operation and shall include such additional tests and certifications as considered required. Such qualifications and requirements shall include precautions necessary to eliminate or minimize hazards that may be present from protective coatings or residues from cargoes.

2. Title 46 CFR 71.60(c)(1) covering hot work on passenger vessels reads as follows:

(a) The provisions of "Standard for the Control of Gas Hazards on Vessels to be Repaired," NFPA No. 306, published by National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269, shall be used as a guide in conducting the inspections and issuance of certificates required by this section.

(b) Until an inspection has been made to determine that such operation can be undertaken with safety, no alterations, repairs, or other such operations involving riveting, welding, burning, or like fire-producing actions shall be made:

(1) Within or on the boundaries of cargo tanks which have been used to carry flammable or combustible liquid or chemicals in bulk, or within spaces adjacent to such cargo tanks; or

(2) Within or on the boundaries of fuel tanks; or

(3) To pipe lines, heating coils, pumps, fittings, or other appurtenances connected to such cargo or fuel tanks.

(c) Such inspections shall be made and evidenced as follows:

(1) In ports or places in the United States or its territories and possessions the inspection shall be made by a Marine Chemist certificated by the National Fire Protection Association; however, if the services of such certified Marine Chemist are not reasonably available, the Officer in Charge, Marine Inspection, upon the recommendation of the vessel owner and his contractor or their representative, shall select a person who, in the case of an individual vessel, shall be authorized to make such inspection. If the inspection indicated that such operations can be undertaken with safety, a certificate setting forth the fact in writing and qualified as may be required, shall be issued by the certified Marine Chemist or the authorized person before the work is started. Such qualifications shall include any requirements as may be deemed necessary to maintain, insofar as can reasonably be done, the safe conditions in the spaces certified throughout the operation and shall include such additional tests and certifications as considered required. Such qualifications and requirements shall include precautions necessary to eliminate or minimize hazards that may be present from protective coatings or residues from cargoes.

3. Title 46 CFR 91.50–1(c)(1) covering hot work on cargo and miscellaneous vessels as follows:

(a) The provisions of "Standard for the Control of Gas Hazards on Vessels to be Repaired," NFPA No. 306, published by National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269, shall be used as a guide in conducting the inspections and issuance of certificates required by this section.

(b) Until an inspection has been made to determine that such operation can be undertaken with safety, no alterations, repairs, or other such operations involving riveting, welding, burning, or like fire-producing actions shall be made:

(1) Within or on the boundaries of cargo tanks which have been used to carry flammable or combustible liquid or chemicals in bulk, or within spaces adjacent to such cargo tanks; or,

(2) Within or on the boundaries of fuel tanks; or,

(3) To pipe lines, heating coils, pumps, fittings, or other appurtenances connected to such cargo or fuel tanks.

(c) Such inspections shall be made and evidenced as follows:

(1) In ports or places in the United States or its territories and possessions the inspection shall be made by a Marine Chemist certificated by the National Fire Protection Association; however, if the services of such certified Marine Chemist are not reasonably available, the Officer in Charge, Marine Inspection, upon the recommendation of the vessel owner and his contractor or their representative, shall select a person who, in the case of an individual vessel, shall be authorized to make such inspection. If the inspection indicated that such operations can be undertaken with safety, a certificate setting forth the fact in writing and qualified as may be required, shall be issued by the certified Marine Chemist or the authorized person before the work is started. Such qualifications shall include any requirements as may be deemed necessary to maintain, insofar as can reasonably be done, the safe conditions in the spaces certified throughout the operation and shall include such additional tests and certifications as considered required. Such qualifications and requirements shall include precautions necessary to eliminate or minimize hazards that may be present from protective coatings or residues from cargoes.