



16715
CG-OES Policy Letter
No. 01-14

From: R.E. Bailey, CAPT
COMDT (CG-OES)

To: Distribution

Subj: GUIDELINES FOR LIQUEFIED NATURAL GAS FUEL TRANSFER OPERATIONS
AND TRAINING OF PERSONNEL ON VESSELS USING NATURAL GAS AS
FUEL

Ref: (a) International Maritime Organization (IMO) Resolution MSC.285(86) - Interim
Guidelines on Safety for Natural Gas-Fueled Engine Installations in Ships.

1. Purpose. This policy letter provides guidance to Coast Guard Captains of the Port (COTPs)/Officers in Charge, Marine Inspection (OCMIs) regarding vessels that use natural gas as fuel and engage in liquefied natural gas (LNG) fuel transfer operations. It addresses fuel transfer operations and training of personnel working on U.S. and foreign vessels that use natural gas as fuel and conduct LNG fuel transfer operations in waters subject to U.S. jurisdiction. This policy does not apply to vessels that carry LNG as a cargo and utilize the boil-off gas as fuel.
2. Action. Cognizant COTPs/OCMIs should use this policy as a guide to help ensure natural gas fueled vessels are operated, and affiliated personnel are trained, in a manner that provides a level of safety that is at least equivalent to that provided for traditional fueled vessels.
3. Directives Affected. None.
4. Background.
 - a. Natural gas is considered by the maritime industry to be a prominent future fuel source for commercial vessels. The International Maritime Organization's designation of North American Emission Control Areas under MARPOL Annex VI has imposed strict emissions limitations on marine engines. Because use of natural gas as ship's fuel would substantially reduce carbon emissions, sulfur emissions, and nitrogen oxide emissions, the shipping industry is exploring conversion from oil-based bunker fuel to much cleaner burning natural gas.
 - b. Existing regulations cover design, equipment, operations, and training of personnel on vessels that carry LNG as cargo and facilities that handle LNG in bulk. However, the use

of LNG as fuel is a relatively new concept in the United States. Although some existing regulations apply to LNG fuel transfer operations, the Coast Guard has not established regulations specifically for vessels that receive LNG for use as fuel.

- c. As a result, the maritime industry is looking to the Coast Guard to fill the “gap” by recommending appropriate safety measures for the safe transfer of LNG and use of LNG as a marine fuel. This policy letter contains recommendations for LNG fuel transfer operations on vessels using LNG as fuel, and for the training of personnel on such vessels.

5. Discussion.

- a. Waterfront facilities handling LNG are subject to existing regulations at 33 CFR part 127. Vessels carrying LNG that is intended for transfer to other vessels for use as fuel also are subject to existing regulations, notably 46 CFR subchapter D, and in most cases 46 CFR part 154, and 33 CFR parts 155 and 156. This policy letter and Enclosure (1) provide guidance for COTPs/OCMIs on how these existing regulations apply to LNG fueling operations. COTPs/OCMIs must ensure that LNG fuel transfer operations comply with existing applicable and enforceable regulations.
- b. Additionally, this policy letter and Enclosures (1) and (2) provide guidance on recommended safety procedures that COTPs/OCMIs should consider when evaluating proposed LNG as fuel transfer operations so that these transfers can occur safely and securely. As a reminder, it is the responsibility of the operator of the facility and/or the transferring vessel to ensure that the receiving vessel has the necessary personnel and equipment to safely and securely participate in the conduct of an LNG transfer operation.
- c. Existing regulations at 33 CFR parts 127, 155, and 156 require transfer procedures be provided. Enclosures (1) and (2) provide recommendations on transfer procedures specific to LNG fuel. Enclosures (3) and (4) provide recommendations for bunkering systems.
- d. Existing regulations at 33 CFR 156.118 allow the COTP to require 4 hours advance notice of the time and place of a transfer operation involving certain facilities and/or self-propelled vessels. The COTP should require this notice where applicable, because this may help the COTP/OCMI ensure that transfer procedures and a declaration of inspection are provided as required by the applicable regulations.
- e. While in waters subject to the jurisdiction of the United States, vessels should only receive LNG for use as fuel from the following sources:

- (1) Waterfront facilities that meet the applicable requirements of 33 CFR Part 127, which includes LNG transfers from tank trucks and rail cars;

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- (2) Vessels that meet the applicable design requirements of 46 CFR Subchapter D and, if applicable, 46 CFR Part 154; or alternate design standards approved by Commandant, U.S. Coast Guard Headquarters, Office of Design and Engineering Standards, (CG-ENG). Please see Enclosure (1), footnote 1, for supplemental information regarding use of manned and unmanned non-self-propelled tank barges.
- f. Transfer of LNG from a vessel using natural gas as fuel should not be conducted, except in the case of emergencies that may endanger the safety of life, property, or the environment, or as otherwise authorized by a COTP for tank cleaning, repair, and similar procedures. This provision does not pertain to vessels that are built and operated to carry LNG as a cargo.
- g. This policy letter does not provide guidance on vessel design criteria for natural gas fuel systems. For policy guidance related to the design criteria of such systems on U.S. certificated vessels, please refer to: CG-521 Policy Letter No. 01-12, dated April 19, 2012. It may be accessed at: <http://www.uscg.mil/hq/cg5/cg521/docs/0112.pdf>. Foreign vessels operating in U.S. waters should provide documentation indicating that the design of its natural gas fuel system complies with reference (a) and has been reviewed and approved by its flag administration or a class society authorized to act on the flag administration's behalf. Questions related to the design of these systems should be referred to the Coast Guard's Office of Design and Engineering Standards (CG-ENG, formerly CG-521).
6. Disclaimer. While the guidance contained in this document may assist the industry, public, Coast Guard, and other Federal and State regulators in applying statutory and regulatory requirements, the guidance is not a substitute for applicable legal requirements nor is it a regulation itself. Each COTP has discretionary authority on how best to address specific safety and security concerns within his/her area of responsibility. Nothing in this policy letter is meant to override or subvert the discretion of the COTP when addressing the unique safety and security concerns for an LNG operation.
7. Changes. This policy letter will be posted on the web at www.homeport.uscg.mil. Changes to this policy will be issued as necessary. Suggestions for improvements of this policy should be submitted in writing to Commandant, U.S. Coast Guard Headquarters, Office of Operating and Environmental Standards, (CG-OES) at the address listed on the first page.

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CG MSC
CG LGC NCOE
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All Area/District (p) offices
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Activities Europe
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Encl: (1) Guidance for LNG Fuel Transfer Operations and Training of Personnel on Vessels
Using Liquefied Natural Gas as Fuel

- (2) Excerpt of Resolution MSC.285(86), Chapter 8, Operational and Training
Requirements
- (3) Excerpt of Resolution MSC.285(86), Chapter 2, Ship Arrangements and System Design
- (4) Excerpt of Resolution MSC.285(86), Chapter 5, Ship Arrangements and System Design

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Guidance for LNG Fuel Transfer Operations and Training of Personnel on Vessels Using Natural Gas as Fuel

The guidelines described below are derived from the Coast Guard's regulations governing the safe design, construction, equipment, inspection, testing and operation of vessels that carry oil and hazardous materials in bulk. With regard to procedures for fuel transfer operations, training of personnel, drills, and specialized equipment, the guidelines below may be used to achieve a level of safety considered equivalent to the regulations applicable to vessels carrying oil and hazardous materials in bulk.

Existing Regulations

Existing 46 CFR Subchapter D prescribes the rules and regulations for tank vessels, including manned and unmanned tank barges, and provides for the uniform administration of vessel inspection requirements applicable to tank vessels carrying regulated cargoes listed in 46 CFR Table 30.25-1. Existing 46 CFR Part 154 prescribes safety standards for self-propelled vessels carrying bulk liquefied gases including natural gas.¹

46 CFR Subchapter D and 46 CFR Part 154 set forth comprehensive regulatory schemes that include requirements for vessel design, construction, equipment, inspections, tests and operations. These regulations direct the owner and operator of the vessel, and agent(s), to ensure that personnel involved in transfer operations possess the appropriate qualifications and understand the procedures to complete a safe transfer. To accomplish this, 46 CFR Subchapter D and 46 CFR Part 154 apply the requirements of 33 CFR Part 155 Subpart C to transfer personnel, procedures, equipment and records.

Existing 33 CFR Part 127 governs the designation and qualifications of the person in charge of a facility transfer operation and sets forth natural gas transfer procedures, noting that transfer requirements applicable to the vessel are published in 46 CFR Part 154 (see 33 CFR 127.319).

Existing regulations also provide for implementation of safety and security measures, such as limited-access safety and security zones, where appropriate (see, generally, 33 CFR part 165).

Operations, Emergency, and Maintenance Manuals

Existing regulations at 33 CFR 127.309 outline the requirements for having operations and emergency manuals at waterfront facilities handling LNG. Additionally, existing regulations at 46 CFR 154.1810 require vessels carrying LNG as cargo to maintain a cargo manual which lists

¹ Manned and unmanned non self-propelled barges are subject to the requirements of 46 CFR Subchapter D. In accordance with 46 CFR 30.01-5(g), manned barges carrying any of the cargoes listed in Table 30.25-1 are considered individually by the Commandant and may be required to comply with the requirements of 46 CFR Subchapter O, as applicable, as well as the requirements of 46 CFR Subchapter D. The U.S. Coast Guard, Headquarters Office of Design and Engineering Standards, Commandant (CG-ENG), has determined that unmanned barges proposed to carry LNG in bulk should also be reviewed under 46 CFR Subchapter O as novel vessel designs that require concept approval.

specific details relative to the cargo, cargo systems, emergency measures, symptoms, and corrective actions to be taken in the event of an emergency. To help ensure LNG operations are conducted safely, each owner or operator of a vessel using natural gas as fuel should develop similar information which is based on specific details of their vessel and their intended operations. Each vessel should have an LNG fuel transfer system operations manual and an emergency manual which includes, but is not limited to, the information below as applicable.

- a. Each LNG fuel transfer system operations manual should contain vessel-specific information, which includes, but is not limited to, the following as applicable:
 - (1) A description of LNG, its handling hazards as a liquid or as a gas, including frostbite or asphyxiation, its safety equipment, and necessary first aid measures;
 - (2) A description of the dangers of asphyxiation from inert gas (if used) on the vessel;
 - (3) The measures that mitigate embrittlement of steel structures as a result of leakage of LNG during transfer operations;
 - (4) A description of the LNG containment system, including pressure and temperature ranges and relief valve settings;
 - (5) A description of the operational conditions of the LNG fuel tanks, including pressures and temperatures for expected operating conditions and associated monitoring equipment;
 - (6) Descriptions and diagrams of the components of the LNG fuel transfer system, including, but not limited to, the following as applicable:
 - (i) Recirculating, vapor, or condensate return system;
 - (ii) LNG fuel tank cool down system;
 - (iii) LNG fuel tank warm-up or vaporization system;
 - (iv) Gas main system;
 - (v) LNG fuel tank or compressor relief system and blocked liquid or gas relief system;
 - (vi) Inerting system;
 - (vii) Boil-off gas compressor or reliquefaction system;
 - (viii) Gas detection systems;
 - (ix) Alarm or safety indication systems; and
 - (x) Systems for venting or using boil-off gas as fuel.
 - (7) A detailed diagram of the LNG fuel transfer area identifying:
 - (i) Electrical sources;
 - (ii) Rating of all electrical components;
 - (iii) Emission sources for gas;
 - (iv) Air intakes, vents, and securing arrangements;

- (v) Fire suppression and detection equipment;
 - (vi) Arrangements for bonding;
 - (vii) Loading manifold and valves;
 - (viii) Hose connections and couplings; and
 - (ix) Emergency shutdown control locations.
- (8) A description of the following conditions and their symptoms, including emergency measures and corrective actions:
- (i) LNG fuel transfer or ballast valve malfunction;
 - (ii) Low and high LNG fuel tank gas pressure;
 - (iii) High LNG fuel tank fill level alarms and shutdowns;
 - (iv) Gas compressor shutdown;
 - (v) Hull cold spot detection;
 - (vi) LNG and natural gas piping leaks;
 - (vii) Primary or secondary LNG tank or pipe barrier failures;
 - (viii) Hold boundary structural failure;
 - (ix) Fire in vent mast head;
 - (x) Reliquefaction plant failure;
 - (xi) Vaporizer malfunction or failure; and
 - (xii) LNG piping or valve freeze-up.
- (9) The maximum relief valve setting or maximum allowable working pressure of the LNG fuel transfer system.
- (10) The procedures for:
- (i) LNG fuel transfer operations, including gauging, cool down, pumping, venting, vapor return, and shutdown;
 - (ii) Conducting inspections before, during, and after use of the LNG fuel transfer system;
 - (iii) LNG fuel transfer operations start-up and shutdown;
 - (iv) Communications systems used during LNG fuel transfer operations; and
 - (v) Gas freeing tanks and piping systems containing residual natural gas for the purpose of conducting hot work.
 - (vi) Performing operations simultaneously while LNG transfer operations are taking place (see paragraph (e) under section heading "Transfer Operations").
- (11) Any other safety matters relating to operation of the LNG fuel transfer equipment, systems, or piping; and
- (12) The duties of each person assigned for LNG fuel transfer operations.
- b. Each emergency manual should contain the following information, as applicable:

- (1) LNG spill response procedures, including contacting response organizations;
- (2) Emergency LNG fuel transfer system shutdown procedures;
- (3) A description of the fire equipment and systems, and their operating procedures;
- (4) A description of the emergency lighting and emergency power systems;
- (5) Emergency contact information for local Coast Guard units, hospitals, fire departments, police departments, and other emergency response organizations;
- (6) First aid procedures and, if there are first aid stations, the locations of each station; and
- (7) Contingency plans for handling the following emergencies:
 - (i) Fire in or near the vicinity of the location where LNG is being transferred;
 - (ii) LNG or natural gas leakage;
 - (iii) Hose or coupling failure;
 - (iv) Mooring line or mooring equipment failure;
 - (v) Communication failure;
 - (vi) Power failure;
 - (vii) Personnel injuries (frost burns, suffocation, etc.);
 - (viii) Emergency departure procedures; and
 - (ix) LNG spills that come into contact with the deck or hull.

c. Each maintenance manual should meet the guidelines specified in Chapter 8, Section 8.3, (Enclosure 2), of IMO Resolution MSC.285(86), "Interim Guidelines on Safety for Natural Gas-Fueled Engine Installations in Ships."

The LNG fuel transfer system operations manual, emergency manual and maintenance manual should be kept up to date and maintained aboard the vessel such that they are readily available to vessel personnel and Coast Guard marine inspectors upon request.

The LNG fuel transfer system operations manual, emergency manual and maintenance manual(s) should be reviewed by the COTP/OCMI for accuracy prior to the start of any LNG fueled vessel operations. COTPs/OCMIs should discuss and become familiar with intended operations, emergency response actions, and plans for periodic maintenance with vessel owners and operators well in advance of any intended operations.

Training

- a. Mariners on U.S. vessels must comply with existing 46 CFR 15.405 (Familiarity with vessel characteristics) and 15.1105 (Familiarization and basic safety training), as appropriate, before assuming their duties and responsibilities. Mariners on non U.S. vessels should receive familiarity training required by the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, (STCW) Regulations I/14.

- b. The training criteria that is provided in Chapter 8, Section 8.2, (Enclosure 2), of IMO Resolution MSC.285(86), Interim Guidelines on Safety for Natural Gas-Fueled Engine Installations in Ships, is considered to provide a level of competence necessary for the safe operation of natural gas fuel systems (see Enclosure 2). Accordingly, each mariner onboard a natural gas fueled vessel should meet the operational and training provisions of the Interim Guidelines appropriate for the position they hold. This applies equally to inspected, uninspected, foreign and domestic natural gas fueled vessels.
- c. Mariners working on board a natural gas fueled vessel who hold a Merchant Mariner's Credential (MMC) endorsed as Tankerman PIC (LG) are considered as meeting category A, B and C Gas-related training criteria of the IMO Resolution MSC.285(86), Chapter 8, Section 8.2, (Enclosure 2), but should still receive company and vessel specific training before assuming their duties (see 46 CFR 15.405 and 15.1105). Also, a mariner working onboard a natural gas fueled vessel who holds a Merchant Mariner's Credential (MMC) endorsed as Tankerman Assistant (LG) is considered as meeting category A training of the IMO training criteria, but should also receive company and vessel specific training before assuming their duties (see 46 CFR 15.405 and 15.1105). Questions concerning training requirements for personnel aboard vessels using natural gas as fuel should be directed to the Maritime Personnel Qualification Division in the U.S. Coast Guard Headquarters, Office of Operating and Environmental Standards (CG-OES-1).

Drills

Gas-related emergency exercises should be conducted at regular intervals and comply with Chapter 8, Section 8.1.3, (Enclosure 2), of IMO Resolution MSC.285(86). These gas-related exercises may include a tabletop exercise, a review of fueling procedures and responses to potential contingencies, tests of equipment intended for contingency response, reviews that assigned personnel are trained to perform assigned duties during fueling and contingency response. Gas-related exercises should be conducted at regular intervals and may be incorporated into the periodic fire drills required by SOLAS Regulation III/19.

Transfer Operations

- a. Person In Charge (PIC): LNG fuel transfer procedures should designate, either by name or by position in the crew, the person in charge of each transfer operation.
- b. Qualifications of PIC: Each person designated as a person in charge of a LNG fuel transfer operation should meet the following qualifications:
 - (1) Holds a Merchant Mariner Credential with an appropriate officer endorsement issued under 46 CFR part 10 and 11, or STCW Chapter II or III for foreign flag vessels, authorizing service on board the vessel; and
 - (2) Meets the training provisions of IMO Resolution MSC.285(86), Chapter 8, Section 8.2.1.2, (Enclosure 2), for Category C.

- c. Notification of Transfer: LNG fuel transfer operations should not be conducted without advance notice given to the local COTP. The time and place of each transfer operation should be provided at least 4 hours before it begins.
- d. Transfer Procedures: Vessels using natural gas as fuel should have transfer procedures that meet the applicable requirements of 33 CFR 155.720 through 155.760, and 33 CFR 156 when transferring LNG:
- (1) To or from the vessel; and
 - (2) From tank to tank within the vessel.
- e. Simultaneous Operations: Currently there is limited experience and little or no published guidance (national or international) addressing the concept of conducting simultaneous shipboard operations (e.g., passenger, cargo, or ship store loading operations, etc.) while LNG fuel transfer operations are taking place. Several international groups, including IMO and ISO, are currently considering developing standards to address this concept; however, their work is preliminary and not expected to be completed until sometime in 2014. As a result, vessel owners/operators considering the need to conduct simultaneous operations should contact and discuss their intentions with the local COTP having jurisdiction over the area where the operation will be conducted. Local COTPs should contact Commandant, U.S. Coast Guard Headquarters, Office of Operating and Environmental Standards, (CG-OES) for assistance when considering simultaneous operations in their areas of responsibility.
- f. Conduct before a LNG Fuel Transfer: The following pre-transfer actions should be conducted by the person in charge of a vessel receiving LNG for use as fuel:
- (1) Inspect the accessible portions of the transfer piping system and equipment to be used during the transfer and ensure that any worn or inoperable parts are replaced;
 - (2) Review and agree with the person in charge of transferring LNG to the vessel as to:
 - (i) The sequence of transfer operations;
 - (ii) The transfer rate;
 - (iii) The duties, location, and watches of each person assigned for transfer operations;
 - (iv) Emergency procedures; and
 - (v) For each of the tanks from which LNG will be transferred, note the pressure, temperature, and volume to ensure that they are safe for transfer to the vessel's tanks and piping systems;
 - (3) Ensure that transfer connections allow the vessel to move to the limits of its moorings without placing strain on the loading arm or transfer piping system;
 - (4) Ensure that each part of the transfer system is aligned to allow the flow of LNG to the desired location;

- (5) Ensure that warning signs are displayed;
 - (6) Eliminate all ignition sources in the transfer area;
 - (7) Ensure that personnel are on duty in accordance with the LNG fuel transfer system operations manual;
 - (8) Ensure firefighting equipment is ready for use; and
 - (9) Test the following to determine that they are operable:
 - (i) The sensing and alarm systems;
 - (ii) The emergency shutdown system; and
 - (iii) The communication systems.
- g. Conduct during a LNG Fuel Transfer: During the LNG fuel transfer operation, the person in charge of receiving LNG for use as fuel should:
- (1) Be in continuous communication with the person in charge of transferring LNG to the vessel;
 - (2) Ensure that an inspection of the transfer piping and equipment for leaks, defects, and other symptoms of safety and operational problems is conducted at regular intervals during transfer; and
 - (3) Ensure that the transfer operations are discontinued before electrical storms or upon notification of any contingency identified in the emergency manual.
- h. Conduct after a LNG Fuel Transfer: After a LNG fuel transfer, the person in charge of receiving LNG for use as fuel should ensure that the hoses, manifold, and piping used during the transfer operation are:
- (1) Properly drained and inerted prior to disconnecting;
 - (2) Free of residual LNG; and
 - (3) Securely blanked.

Vessel Equipment

- a. Bunkering Systems: Bunkering system should comply with Chapter 2, Section 2.9.2, (Enclosure 3), of IMO Resolution MSC.285(86).
- b. Deck Lighting: A vessel engaged in transfer operations between sunset and sunrise should have deck lighting that illuminates the transfer area, and is suitable for service in the intended location including meeting any applicable hazardous area equipment requirements. Lighting

should be located or shielded so as not to mislead or otherwise interfere with navigation on the adjacent waterways. Lighting should adequately illuminate:

- (1) Each transfer operation's work area and each transfer connection point in use on the vessel; and
 - (2) Each transfer operation's work area and each transfer connection point in use in the transfer system transferring to the vessel.
- c. Where the illumination is apparently inadequate, it may be verified by instruments that measure the levels of illumination. On a horizontal plane 3 feet above the deck the illumination should measure at least:
- (1) 5.0 foot-candles at transfer connection points; and
 - (2) 1.0 foot-candle in transfer operations work areas.
- d. Personnel Protection: Personal protective equipment should be provided for use by personnel engaged in operations involving the handling of LNG. The following personal protective equipment should be suitable for use with LNG and provided in a place where it is readily available to personnel:
- (1) Gloves;
 - (2) Eye protection; and
 - (3) Protective clothing.
- e. Portable Gas Detectors: Each vessel using LNG as fuel should have two portable gas detectors capable of measuring 0-100% of the lower flammable limit of methane and be readily available for use by personnel engaged in LNG fuel transfer operations.
- f. Radio and Communication Equipment: Radio and communication equipment should meet the following specifications:
- (1) Radio and communication equipment with antennas located where flammable gas may accumulate should be secured prior to transfer;
 - (2) Portable radio devices for use during the LNG fuel transfer operations should be tested and listed or certified intrinsically safe (UL 913 or IEC 60079-11, Ex "ia") by an independent laboratory accepted by the Commandant under 46 CFR part 159;
 - (3) Portable electronic devices such as mobile phones, cameras, and other devices using batteries should not be allowed in hazardous areas unless they are listed or certified intrinsically safe (UL 913 or IEC 60079-11, Ex "ia") by an independent laboratory

accepted by the Commandant under 46 CFR part 159; and

(4) Antennas of radio and communication equipment should be located in unclassified locations when possible. The antenna location should not pose an obstruction to helicopter landing areas, platform cranes, or other unit operations, and antenna feed lines should be protected from possible physical damage.

- g. LNG Fuel Transfer Hoses: LNG fuel transfer hoses stored on the vessel for the purpose of transferring LNG for use as fuel on the vessel should meet the requirements of 46 CFR 154.551.

Transfer hose connections should include provisions to prevent electrical flow during connection or disconnection of the transfer hose string through the hose string or the loading arm. Insertion of one short length of non-conducting hose without internal bonding in each transfer hose string or installation of an insulating flange should be addressed.

Each transfer hose string should contain only one electrically discontinuous length of hose or insulating flange to prevent electrostatic build-up in the hose string.

- h. LNG Bunkering Manifold: The LNG bunkering manifold should be designed to withstand the external loads during bunkering. The connections at the bunkering station should be of a dry-disconnect type equipped with additional safety dry break-away coupling/self-sealing quick release.
- i. Emergency Shutdown: An emergency shutdown system should be provided for the LNG fuel transfer system at each transfer control location. The system should be capable of manual, remote, and automatic operation of the shutdown valve required in IMO Resolution MSC.285(86), Chapter 2, Section 2.9.2.2, (Enclosure 3), and may be integrated with the safety systems described in 46 CFR 62.35-50.

The remotely operated valve should shutdown upon:

- (1) Manual activation of the emergency shutdown system from the transfer control location;
and
- (2) Automatic activation by the vessel's:
 - (i) Gas detection system;
 - (ii) Fire detection system; and
 - (iii) High fuel tank level detection system.

- j. Alarms and Indicators: Alarms and indicators should be installed as outlined by IMO Resolution MSC.285(86), Chapter 2, Sections 2.9.1.3, 2.9.2.3, 2.9.2.4, (Enclosure 3), and Chapter 5, Section 5.2.2, (Enclosure 4), and should be co-located with the controls for

manual activation of the emergency shutdown system. Remote indicators for pressure in the transfer lines and between the stop valve and connection to shore at each transfer pipe should also be provided at the transfer control location.

Miscellaneous

- k. Hot Work: No person should be allowed to conduct welding, torch cutting, or other hot work on a vessel using LNG as fuel unless:
- (1) The COTP has issued a permit for that hot work; and
 - (2) The conditions of the permit are met.

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**RESOLUTION MSC.285(86)
(adopted on 1 June 2009)
(Excerpt of)**

**INTERIM GUIDELINES ON SAFETY FOR NATURAL GAS-FUELLED ENGINE
INSTALLATIONS IN SHIPS**

This excerpt (Chapter 8 of MSC.285(86)) constitutes a fair use of copyrighted material as provided for in Title 17 of the United States Code, § 107 of the Copyright Act of 1976, as amended.

For the complete text of MSC.285(86), please visit <http://www.imo.org/KnowledgeCentre>.

CHAPTER 8

OPERATIONAL AND TRAINING REQUIREMENTS

8.1 Operational requirement

8.1.1 The whole operational crew of a gas-fuelled cargo and a passenger ship should have necessary training in gas-related safety, operation and maintenance prior to the commencement of work on board.

8.1.2 Additionally, crew members with a direct responsibility for the operation of gas-related equipment on board should receive special training. The company should document that the personnel have acquired the necessary knowledge and that this knowledge is maintained at all times.

8.1.3 Gas-related emergency exercises should be conducted at regular intervals. Safety and response systems for the handling of defined hazards and accidents should be reviewed and tested.

8.1.4 A training manual should be developed and a training program and exercises should be specially designed for each individual vessel and its gas installations.

8.2 Gas-related training

8.2.1 *Training in general*

The training on gas-fuelled ships is divided into the following categories:

- .1 category A: Basic training for the basic safety crew;
- .2 category B: Supplementary training for deck officers; and
- .3 category C: Supplementary training for engineer officers.

8.2.1.1 Category A training

- .1 The goal of the category A training should provide the basic safety crew with a basic understanding of the gas in question as a fuel, the technical properties of liquid and compressed gas, explosion limits, ignition sources, risk reducing and consequence reducing measures, and the rules and procedures that must be followed during normal operation and in emergency situations.
- .2 The general basic training required for the basic safety crew is based on the assumption that the crew does not have any prior knowledge of gas, gas engines and gas systems. The instructors should include one or more of the suppliers of the technical gas equipment or gas systems, alternatively other specialists with in-depth knowledge of the gas in question and the technical gas systems that are installed on board.
- .3 The training should consist of both theoretical and practical exercises that involve gas and the relevant systems, as well as personal protection while handling liquid and compressed gas. Practical extinguishing of gas fires should form part of the training, and should take place at an approved safety centre.

8.2.1.2 Categories B and C training

- .1 Deck and engineer officers should have gas training beyond the general basic training. Category B and category C training should be divided technically between deck and engineer officers. The company's training manager and the master should determine what comes under deck operations and what comes under engineering.
- .2 Those ordinary crew members who are to participate in the actual bunkering work, as well as gas purging, or are to perform work on gas engines or gas installations, etc., should participate in all or parts of the training for category B/C. The company and the master are responsible for arranging such training based on an evaluation of the concerned crew members job instructions/area of responsibility on board.
- .3 The instructors used for such supplementary training should be the same as outlined for category A.
- .4 All gas-related systems on board should be reviewed. The ships maintenance manual, gas supply system manual and manual for electrical equipment in explosion hazardous spaces and zones should be used as a basis for this part of the training.
- .5 This regulation should be regularly reviewed by the company and onboard senior management team as part of the SMS system. Risk analysis should be emphasized, and any risk analysis and sub-analyses performed should be available to course participants during training.

- .6 If the ship's own crew will be performing technical maintenance of gas equipment, the training for this type of work should be documented.
- .7 The master and the chief engineer officer should give the basic safety crew on board their final clearance prior to the entry into service of the ship. The clearance document should only apply to gas-related training, and it should be signed by both the master/chief engineer officer and the course participant. The clearance document for gas-related training may be integrated in the ships general training program, but it should be clearly evident what is regarded as gas-related training and what is regarded as other training.
- .8 The training requirements related to the gas system should be evaluated in the same manner as other training requirements on board at least once a year. The training plan should be evaluated at regular intervals.

8.3 Maintenance

- 8.3.1 A special maintenance manual should be prepared for the gas supply system on board.
- 8.3.2 The manual should include maintenance procedures for all technical gas-related installations, and should comply with the recommendations of the suppliers of the equipment. The intervals for, and the extent of, the replacement/approval of gas valves should be established. The maintenance procedure should specify who is qualified to carry out maintenance.
- 8.3.3 A special maintenance manual should be prepared for electrical equipment that is installed in explosion hazardous spaces and areas. The inspection and maintenance of electrical installations in explosion hazardous spaces should be performed in accordance with a recognized standard.
- 8.3.4 Any personnel that should carry out inspections and maintenance of electrical installations in explosion hazardous spaces should be qualified pursuant to IEC 60079-17, item 4.2.

**RESOLUTION MSC.285(86)
(adopted on 1 June 2009)
(Excerpt of)**

**INTERIM GUIDELINES ON SAFETY FOR NATURAL GAS-FUELLED ENGINE
INSTALLATIONS IN SHIPS**

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2.8.4.5 Bilge suction from the tank room, if provided, should not be connected to the bilge system for the rest of the ship.

2.9 Fuel bunkering system and distribution system outside machinery spaces

2.9.1 Fuel bunkering station

2.9.1.1 The bunkering station should be so located that sufficient natural ventilation is provided. Closed or semi-enclosed bunkering stations should be subject to special consideration. The bunkering station should be physically separated or structurally shielded from accommodation, cargo/working deck and control stations. Connections and piping should be so positioned and arranged that any damage to the gas piping does not cause damage to the vessel's gas storage tank arrangement leading to uncontrolled gas discharge.

2.9.1.2 Drip trays should be fitted below liquid gas bunkering connections and where leakage may occur. The drip trays should be made of stainless steel, and should be drained over the ship's side by a pipe that preferably leads down near the sea. This pipe could be temporarily fitted for bunkering operations. The surrounding hull or deck structures should not be exposed to unacceptable cooling, in case of leakage of liquid gas. For compressed gas bunkering stations, low temperature steel shielding should be provided to prevent the possible escape of cold jets impinging on surrounding hull structure.

2.9.1.3 Control of the bunkering should be possible from a safe location in regard to bunkering operations. At this location tank pressure and tank level should be monitored. Overfill alarm and automatic shutdown should also be indicated at this location.

2.9.2 Bunkering system

2.9.2.1 The bunkering system should be so arranged that no gas is discharged to air during filling of storage tanks.

2.9.2.2 A manually-operated stop valve and a remote operated shutdown valve in series, or a combined manually-operated and remote valve should be fitted in every bunkering line close to

the shore connecting point. It should be possible to release the remote-operated valve in the control location for bunkering operations and or another safe location.

2.9.2.3 If the ventilation in the ducting around the gas bunkering lines stops, an audible and visual alarm should be provided at bunkering control location.

2.9.2.4 If gas is detected in the ducting around the bunkering lines an audible and visual alarm should be provided at the bunkering control location.

2.9.2.5 Means should be provided for draining the liquid from the bunkering pipes at bunkering completion.

2.9.2.6 Bunkering lines should be arranged for inerting and gas freeing. During operation of the vessel the bunkering pipes should be gas free.

2.9.3 *Distribution outside of machinery spaces*

2.9.3.1 Gas fuel piping should not be led through accommodation spaces, service spaces or control stations.

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5.2.2 Each tank should be monitored with at least one local indicating instrument for pressure and remote pressure indication at the control position. The pressure indicators should be clearly marked with the highest and lowest pressure permitted in the tank. In addition, high-pressure alarm, and if vacuum protection is required, low pressure alarm should be provided on the bridge. The alarms should be activated before the set pressures of the safety valves are reached.

5.3 Gas compressor monitoring

Gas compressors should be fitted with audible and visual alarms both on the bridge and in the engine-room. As a minimum the alarms should be in relation to low gas input pressure, low gas output pressure, high gas output pressure and compressor operation.

5.4 Gas engine monitoring

5.4.1 Additional to the instrumentation provided in accordance with SOLAS chapter II-1, Part C, indicators should be fitted on the navigation bridge, the engine control room and the manoeuvring platform for:

- .1 operation of the engine in case of gas-only engines; or
- .2 operation and mode of operation of the engine in the case of dual fuel engines.

5.4.2 Auxiliary systems where gas may leak directly into the system medium (lubricating oil, cooling water) should be equipped with appropriate gas extraction measures fitted directly after the outlet from the engine in order to prevent gas dispersion. The gas extracted from auxiliary systems media should be vented to a safe location in the open.

5.5 Gas detection

5.5.1 Permanently installed gas detectors should be fitted in the tank room, in all ducts around gas pipes, in machinery spaces of the ESD-protected type, compressor rooms and other enclosed spaces containing gas piping or other gas equipment without ducting. In each ESD-protected machinery space, two independent gas detector systems should be required.

5.5.2 The number of detectors in each space should be considered taking size, layout and ventilation of the space into account.

5.5.3 The detection equipment should be located where gas may accumulate and/or in the ventilation outlets. Gas dispersal analysis or a physical smoke test should be used to find the best arrangement.

5.5.4 An audible and visible alarm should be activated before the vapour concentration reaches 20% of the lower explosion limit (LEL). For ventilated ducts around gas pipes in the machinery spaces containing gas-fuelled engines, the alarm limit can be set to 30% LEL. The protective system should be activated at a LEL of 40%.

5.5.5 Audible and visible alarms from the gas detection equipment should be located on the bridge and in the engine control room.

5.5.6 Gas detection for gas pipe ducts and machinery spaces containing gas-fuelled engines should be continuous without delay.

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