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NAVIGATION AND VESSEL INSPECTION CIRCULAR NO. 2-88

SUBJ: Inerting Requirements for Chemical Tankers and Gas Carriers

1. PURPOSE. The purpose of this NVIC is to provide guidance and information pertaining to inert gas systems (IGS) for chemical tankers and liquefied gas carriers. This circular will serve as an easy-to-use guide for determining the inerting requirements for chemical tankers and gas carriers carrying flammable cargoes.
2. BACKGROUND.
  - a. Inerting of cargo tanks containing flammable liquids is a safe and effective means of preventing explosions. This is accomplished by preventing vapors from combining with air (oxygen) in concentrations within the flammable limits of a cargo.
  - b. The need to require IGS on board tankships carrying flammable liquids was first recognized during the late 1960's when a series of disastrous explosions beset the industry. In response, IGS regulations for tankers carrying crude oil and petroleum products were implemented domestically (46 CFR 32.53) and internationally (International Convention for the Safety of Life at Sea (SOLAS) Regulation 11-2/60) For chemical tankers and gas carriers the applicability of alternate inerting requirements as allowed by SOLAS Regulation 11-2/55.5 were adopted in 1985 through the International Maritime Organization (IMO) Assembly Resolution A.566(14).
  - c. The following terms and definitions are essential to understanding the contents of this NVIC:
    - (1) Flashpoint - the temperature in degrees Celsius (Fahrenheit) at which a product will give off enough flammable vapor to be ignited (ASTM D-93, Closed Cup Test).
    - (2) Flammable Liquid - cargo with flashpoint not exceeding 60°C (140°F; SOLAS Reg. 11-2/55.1); this definition differs from the definition found in 46 CFR 30.10-22.
    - (3) Flammable Limits - the range of gas or vapor concentrations (percent by volume in air) which will burn or explode if an ignition source is present; limiting concentrations are commonly called the "lower flammable limit" (LFL) and the "upper flammable limit" (UFL); below the LFL the mixture is too lean to burn, and above the UFL it is too rich to burn.
    - (4) Inerting - the process of decreasing and maintaining a decreased oxygen concentration (not exceeding 8% by volume) in a cargo tank and associated piping systems through the introduction of an inert gas so that the tank atmosphere will neither support combustion, even in the presence of flammable vapors, nor react with the cargo.

- (5) Chemical Tanker - a cargo ship constructed or adapted and used for the carriage in bulk of any liquid product listed in Table 1 of 46 CFR 153, Chapter VI of the BCH Code, or Chapter 17 of the IBC Code.
- (6) Gas Carrier - a cargo ship constructed or adapted and used for the carriage in bulk of any liquefied gas or other cargo listed in Table 4 of 46 CFR 154, Chapter XIX of the GC Code, or Chapter 19 of the IGC Code.
- (7) 46 CFR Part 153 - "Safety Rules for Self-Propelled Vessels Carrying Hazardous Liquids"; applies to all U.S. flag chemical tankers and foreign flag chemical tankers in U.S. waters.
- (8) BCH Code - (Bulk Chemical Code) "MO Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk"; applies to chemical tankers with keels laid before 1 July 1986.
- (9) IBC Code - (International Bulk Chemical Code) "International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk"; Volume II of the 1983 Amendments to SOLAS '74, as amended (incorporated by reference); applies to chemical tankers with keels laid on or after 1 July 1986.
- (10) 46 CFR Part 154 - "Safety Standards for Self-Propelled Vessels Carrying Bulk Liquefied Gases"; applies to all "new" U.S. flag gas carriers and foreign flag gas carriers entering U.S. waters ("New" is defined within Part 154).
- (11) GC Code - (Gas Carrier Code) "MO Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk"; applies to gas carriers with keels laid before 1 July 1986.
- (12) IGC Code - (International Gas Carrier Code) "International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk"; Volume III of the 1983 Amendments to SOLAS '74, as amended (incorporated by reference); applies to gas carriers with keels laid on or after 1 July 1986.
- (13) Res. A.473(XII) - 'MO Assembly Resolution A.473(XII); "Interim Regulation for Inert Gas Systems on Chemical Tankers Carrying Petroleum Products.
- (14) Res. A.566(14) - 'MO Assembly Resolution A.566(14); "Draft Amendment to Regulation 11-2/55.5 of SOLAS 174, as amended."
- (15) Res. A.567(14) - 'MO Assembly Resolution A.567(14); "Regulation for Inert Gas Systems on Chemical Tankers."

d. Publications named in subparagraphs 2.c. (7) through (15) above may be found in nautical book stores or can be obtained from the following:

(1) U.S. Publications

Superintendent of Documents  
U.S. Government Printing Office  
Washington, DC 20402

(2) International Maritime Organization (IMO) Publications  
International Maritime Organization

Publications Section  
4 Albert Embankment  
London SE1 75R  
Telephone: 01-735-7611  
Telex: 23588

3. DISCUSSION.

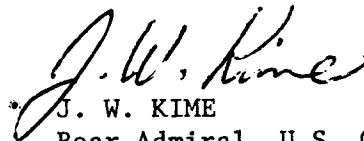
- a. The modern chemical tanker is designed for the simultaneous carriage of many different cargoes such as those listed in 46 CFR 153, chapters VI and VII of the BCH Code, and Chapters 17 and 18 of the IBC Code. Chemical tankers usually feature large numbers of very small capacity tanks (as compared to crude oil and petroleum product tankers). Gas carriers do not necessarily share this design feature; however, they must be capable of meeting the carriage conditions specified for a chemical cargo before that cargo can be authorized.
- b. In considering the application of IGS requirements to chemical tankers, it was argued that this type of tanker should be given special consideration. This is primarily because the inert gas from shipboard IGS and impurities in the inert gas can contaminate chemical cargoes. For example, the carbon dioxide produced as an inerting agent can drive certain cargoes off specification. Additionally, there are other chemical cargoes which are shipped with inhibitors that react with the oxygen in the tank to prevent the cargo from undergoing unwanted reactions. Therefore, the displacement of oxygen through inerting by any means (bottled nitrogen, inert gas generator, flue gas systems, etc.) can cause breakdown of inhibitors required to prevent these reactions.
- c. The case for special consideration for chemical tankers is strongly supported by the excellent safety record of chemical tankers designed, constructed and operated to the standards of 46 CFR 153, the BCH Code, and the IBC Code. Service experience has shown that because of the smaller capacity tanks, sophisticated cargo handling systems, and better trained crews found on board chemical tankers, the potential causes of explosions are minimized. [NOTE: Some cargoes listed in Table 1 of 46 CFR 153, Chapter VI of the BCH Code, and Chapter 17 of the IBC Code are subject to special inerting requirements for reasons other than to prevent a flammable atmosphere in a tank (i.e. to prevent reaction of the cargo with oxygen or water vapor present in air). These special requirements are identified in Table 1 of 46 CFR 153, Chapter VI of the BCH Code, and Chapter 17 of the IBC Code. In some cases commercially pure nitrogen is used to meet these special inerting requirements.]
- d. Since the implementation of the 1993 Amendments to SOLAS 174, Regulation 11-2155.5 has allowed for substitute inerting requirements to be applied to chemical tankers and gas carriers in lieu of the requirements in Regulation 11-2/60. These substitute requirements are contained in Res. A.473(XII), adopted on 19 November 1981. They apply to chemical tankers and gas carriers carrying petroleum products only.
- e. The inert gas applicability requirements set out in Regulation 11-2/55.5 are further modified by Res. A.566(14). In addition to the substitute requirements of Res. A.473(XII), Res. A.566(14) allows for compliance with the inerting requirements of Res. A.567(14), adopted on 20 November 1985. This extends the applicability of substitute inerting requirements to the carriage of all flammable cargoes on board chemical tankers and gas carriers. Res. A.566(14) also prescribes the conditions under which no inerting is required.

4. IMPLEMENTATION.

- a. Res. A.566(14) applies only to chemical tankers and gas carriers which would otherwise be subject to the IGS requirements of 46 CFR 32.53 and SOLAS Regulation 11-2/60 for tankers carrying crude oil and petroleum products. These include all "new" chemical tankers and gas carriers of 20,000 deadweight tons or more, as well as, those "existing" vessels of 40,000 deadweight tons or more. It also includes those "existing" vessels of 20,000 deadweight tons or more, but less than 40,000 deadweight tons if fitted with tank washing machines having an individual throughput of greater than 60 cubic meters per hour. The dates distinguishing "new" from "existing" for the purpose of applying IGS requirements are contained in 46 USC 3701 and the 1978 protocol to SOLAS '74. For easy reference, those dates are included in this circular as Note 2 of enclosure (1).
- b. After establishing that the IGS requirements for tankers carrying crude oil and petroleum products would otherwise apply, it must be confirmed that the ship in question is a chemical tanker or gas carrier. The definitions provided in paragraph 2 above should be used for this. As evidence a vessel meets the applicable definition, it must be in possession of a valid Certificate of Inspection (COI) (U.S. flag) or 'MO Certificate of Fitness (foreign flag) endorsed for the carriage of at least one cargo appearing in the Tables/Chapters specified in the definition. For example, a U.S. flag tanker in possession of a valid COI, endorsed for the carriage of any cargo listed in Table 1 of 46 CFR 153, is considered to be a chemical tanker.
- c. Next, each flammable cargo to be carried must be considered individually to determine the inerting requirements applicable to the tank in which the cargo is being carried. The flammable cargoes should be divided into the following three categories:
  - (1) Crude oil;
  - (2) Petroleum products; and
  - (3) "Other than crude oil or petroleum products." [NOTE: Flammable cargoes "other than crude oil or petroleum products" are those listed in Table 1 of 46 CFR 153, Chapters VI or VII of the BCH Code, or Chapters 17 or 18 of the IBC Code. The cargoes listed in Table 1 of 46 CFR 153 closely parallel those listed in Chapter VI of the BCH Code and Chapter 17 of the IBC Code. There is no listing in U.S. regulations parallel to Chapter VII of the BCH Code and Chapter 18 of the IBC Code (Chapters VII and 18 are identical); however, many of those cargoes are listed in 46 CFR 30.25-1.]
- d. For chemical tankers and gas carriers carrying flammable cargoes "other than crude oil or petroleum products," there are no inerting requirements provided the vessel was constructed before 1 July 1986. If the vessel was constructed on or after 1 July 1986, no inerting is required provided the following stipulations are met:
  - (1) The individual tank(s) involved do not have a capacity exceeding 3000 m<sup>3</sup>;
  - (2) The individual nozzle capacities of the tank washing machines do not exceed 17.5 m<sup>3</sup>/hr; and
  - (3) The total throughput for all the machines in use in a tank does not exceed 110 m<sup>3</sup>/hr.
- e. For all chemical tankers carrying flammable crude oil or petroleum products, the IGS requirements of Res. A.567(14) apply. If a chemical tanker was constructed before 1 July 1986, the IGS requirements of Res. A.473(XII) may be substituted for those in Res. A.567(14). The same requirements as included in this paragraph for chemical tankers or

an equivalent should be applied to gas carriers when carrying flammable crude oil or petroleum products.

- f. There may be instances when a flammable cargo which is not crude oil or a petroleum product also is not listed in 46 CFR 153, the BCH Code, or the IBC Code. This is most likely to occur when a new chemical is marketed and first transported. In situations such as this or any other time there is uncertainty regarding the inerting requirements for a particular cargo carried on board a chemical tanker or gas carrier, Commandant (G-MTH-I, 202-267-1217) should be consulted.
- g. A decision diagram is enclosed to aid in determining the applicable inerting requirements as discussed above.



J. W. KIME  
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Encl.: (1) Decision diagram

Note 1: Applies only to chemical tankers and gas carriers which would otherwise be subject to the IGS requirements of 46 CFR 32.53 and SOLAS Regulation 11-2/60 for tankers carrying crude oil and petroleum products. These include all "new" chemical tankers and gas carriers of 20,000 deadweight tons or more, as well as, those "existing" vessels of 40,000 deadweight tons or more. It also includes those "existing" vessels of 20,000 deadweight tons or more, but less than 40,000 deadweight tons if fitted with tank washing machines having an individual throughput of greater than 60 cubic meters per hour. The dates distinguishing "new" from "existing" for the purpose of applying IGS requirements are contained in 46 USC 3701 and the protocol to SOLAS '74. For easy reference, those dates are included below in Note 2.

Note 2: §3701 Definitions In this chapter-

- (1) "existing," when referring to a type of vessel to which this chapter applies, means a vessel that is not a new vessel.
- (2) "major conversion" means a conversion of an existing vessel that substantially changes the dimensions or carrying capacity of the vessel or changes the type of vessel or substantially prolongs its life or that otherwise so changes the vessel that it is essentially a new vessel as decided by the Secretary.
- (3) "new" when referring to a type of vessel to which this chapter applies, means a vessel-
  - (A) for which the building contract is placed after June 1, 1979;
  - (B) in the absence of a building contract, the keel of which is laid, or which is at a similar stage of construction, after January 1, 1980;
  - (C) the delivery of which is after June 1, 1982; or
  - (D) that has undergone a major conversion under a contract made after June 1, 1979, or construction work that began after January 1, 1980, or was completed after June 1, 1982.