



Inert gas systems

The use of inert gas for the carriage of flammable oil cargoes

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Abbreviations and glossary

The following are agreed definitions for terms used within this paper:

CDI

Chemical Distribution Institute

Deadweight (DWT)

The carrying capacity of a ship, including cargo, bunkers and stores, expressed in metric tonnes. It can be given for any draught, but here is used to indicate summer deadweight at summer draught.

Guidance

Provision of advice or information by OCIMF.

IMO

International Maritime Organization

Inert condition

A condition in which the oxygen content throughout the atmosphere of a tank has been reduced to 8% or less by volume by the addition of inert gas.

Inert gas

A gas or a mixture of gases, such as flue gas, containing insufficient oxygen to support the combustion of hydrocarbons.

Inert gas plant

All equipment fitted to supply, cool, clean, pressurise, monitor and control the delivery of inert gas to the cargo tank systems.

Inert Gas System (IGS)

An inert gas plant and inert gas distribution system together with means for preventing backflow of cargo gases to the machinery spaces, fixed and portable measuring instruments and control devices.

SOLAS

International Convention for the Safety of Life at Sea

Bibliography

CDI

CDI Best Practice Recommendations Regarding the use of Nitrogen

The publication provides recommended procedures for the safe handling of nitrogen on chemical tankers.

ICS

Tanker Safety Guide (Chemicals)

Chapter 5 contains useful information on the requirements for inert gas and options for sourcing including Nitrogen generators.

IMO

International Convention for the Safety of Life at Sea 1974, as amended (SOLAS)

Chapter II-2, Part B Prevention of Fire and Explosion contains carriage and operational requirements for inert gas systems.

International Code for Fire Safety Systems (FSS Code)

Chapter 15 *Inert Gas Systems* details the specifications for inert gas systems as required by SOLAS Chapter II-2.

Inert Gas Systems

Comprehensive guidelines containing details of the design and operation of inert gas systems together with legislative requirements.

Study on incidents of explosions on chemical and product tankers (IMO MSC 81/8/1)

This document summarises the activities and conclusions of the inter-industry working group formed to investigate fires and explosions on chemical and product tankers.

OCIMF/ICS/IAPH

The International Safety Guide for Oil Tankers and Terminals (ISGOTT)

Contains comprehensive guidance on inert gas systems and operational procedures.

1 Introduction

Hydrocarbon gas normally carried in petroleum tankers cannot burn in an atmosphere containing less than approximately 11% oxygen by volume. Accordingly, one way to provide protection against fires or explosions in the vapour space of cargo tanks is to keep the oxygen level below that figure. This is usually achieved by using a fixed piping arrangement to blow inert gas into each cargo tank in order to reduce the oxygen content and render the tank atmosphere non-flammable.

The International Convention for the Safety of Life at Sea (SOLAS 1974), as amended, requires that inert gas systems be capable of delivering inert gas with an oxygen content in the inert gas main of not more than 5% by volume. By maintaining a positive pressure in the cargo tanks at all times, with an atmosphere not having an oxygen content greater than 8% by volume, the tank atmosphere is rendered non-flammable.

This document provides guidance on the use of inert gas for the carriage of flammable oil cargoes on oil tankers of all sizes. For the purposes of this paper, and in accordance with SOLAS Chapter II-2, Regulation 1-6.1, flammable oil cargoes are defined as crude oil or petroleum products that have both:

- A flashpoint of less than 60°C in a closed cup test using approved flashpoint apparatus.
- A Reid vapour pressure below the atmospheric pressure or other liquid products that have a similar fire hazard.

This paper is based on historical incidents involving fires and explosions in the cargo areas on tankers carrying flammable cargoes. The guidance establishes the safety benefits of using inert gas as an effective barrier to prevent cargo tank fires and explosions, regardless of vessel size.

This paper does not offer guidance for chemical tankers carrying chemical cargoes. OCIMF supports the guidance issued by CDI, in *CDI Best Practice Recommendations Regarding the use of Nitrogen*. The CDI recommends that all cargo and tank cleaning operations involving flammable chemical cargoes are carried out whilst the relevant cargo tanks are inerted by nitrogen.

2 Legislation

The SOLAS requirements for tankers to be fitted with an inert gas system were developed by the IMO and had initially entered into force in 1980 for tankers 100,000 DWT and upwards. The SOLAS amendments, that entered into force 1981, reduced the threshold to 20,000 DWT.

The SOLAS amendments, that entered into force on 1 January 2016, reduced the threshold further and require new build tankers 8,000 DWT and over, constructed on or after this date, to be fitted with an inert gas system when carrying flammable cargoes.

OCIMF welcomes these changes; however, the principle of basing inert gas requirements on vessel DWT does not adequately recognise the risks posed by flammable oil cargoes or the proven safety benefits of carrying such cargoes under inert conditions.

3 Review of incidents

3.1 Historical incident review

In 2006, an inter-industry working group, formed to investigate fires and explosions in cargo areas on oil and chemical tankers, presented its findings to the IMO Maritime Safety Committee (MSC 81/8/1 and MSC 81-INF.8). The group examined 35 incidents that had occurred over the previous 25 years and the report noted that:

- In the majority of cases the ship was tank cleaning, venting or gas freeing when the incidents occurred.
- Failure to follow established procedures was observed in a significant number of incidents.
- In several cases, the tank atmosphere for non-inerted tanks had apparently not been evaluated or was not being monitored.
- In most cases ignition occurred within a cargo tank.
- None of the incidents occurred during the use or operation of inert gas.

The inter-industry working group report was considered by IMO delegates and influenced the debate that resulted in the adoption of the 2014 SOLAS amendments and the consequent reduction in the oil tanker DWT requirements for fitting inert gas systems from 20,000 DWT to 8,000 DWT for tankers constructed on or after 1 January 2016 when carrying flammable cargoes.

3.2 OCIMF analysis of incidents 2004–2015

OCIMF has undertaken a further study of incidents involving fires and explosions in the cargo area on tankers during the period 2004–2015 where maintaining the cargo tank in an inert condition is likely to have prevented the incident. For consistency with the IMO study oil and chemical cargoes have been included.

The data, which was collected from public and member incident databases, indicated that a total of 15 incidents involving fires and explosions occurred in the cargo area over the 12-year time frame. From the data reviewed by OCIMF, these events resulted in 20 fatalities and a further 30 people missing, presumed dead.

Vessel	8,000 DWT or less	8,000-20,000 DWT	20,000+ DWT	Oil cargo	Chemical cargo	Activity
1	X			X		Tank cleaning
2	X			X		Gas freeing
3	X				X	Loading
4		X		X		Tank cleaning
5			X		X	Gas freeing
6		X			X	Discharging
7			X		X	Tank cleaning
8			X	X		Tank cleaning
9			X		X	Loading
10	X			X		Tank cleaning
11	X			X		Ballast condition
12		X		X		Tank cleaning
13			X	X		Decanting slop tank
14	X			X		Deck maintenance
15	X				X	Tank cleaning

Table 3.1: Number of fires and explosions on oil and chemical tankers 2004–2015

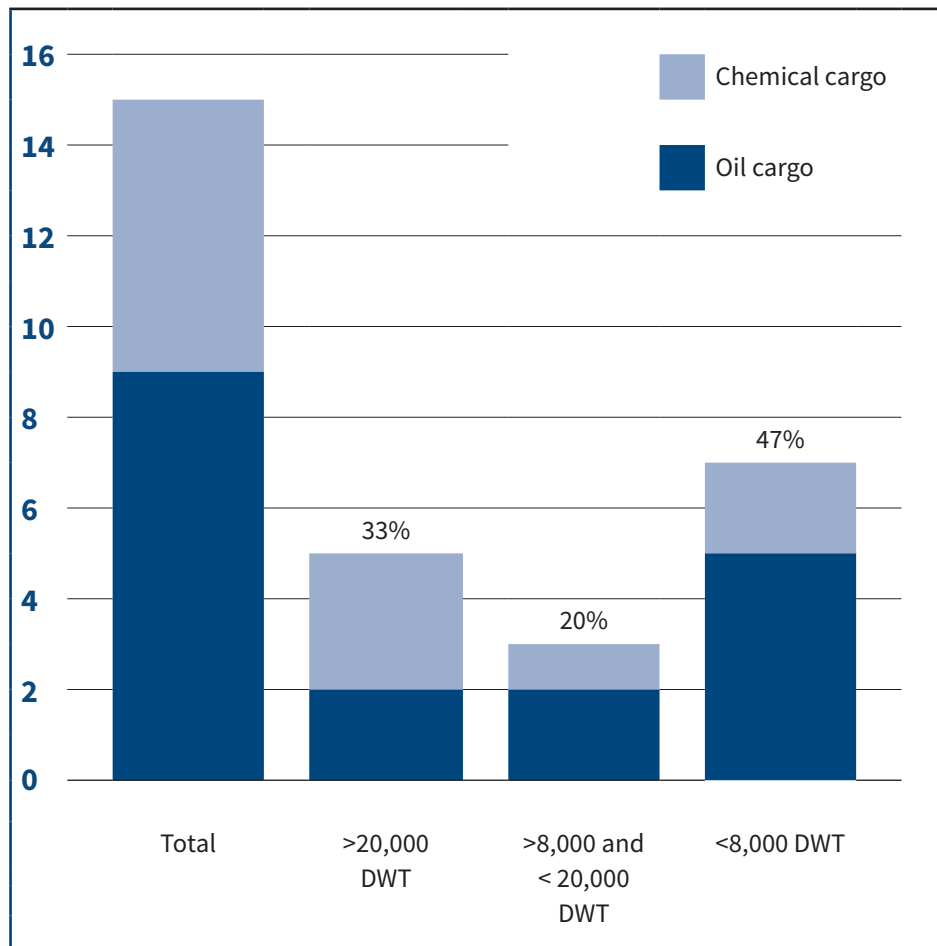


Figure 3.1: Number of fires and explosions with oil cargoes and chemical cargoes 2004–2015

The data indicated that a majority of the incidents involving fires and explosions occurred on vessels less than 20,000 DWT. The two incidents involving fires and explosions on oil tankers greater than 20,000 DWT occurred on vessels with inert gas systems installed; however, the tank was not being maintained in an inert condition at the time of the incident.

The study supports that the provision of inert gas on vessels over 20,000 DWT carrying oil cargoes is preventing incidents involving fires and explosions. There continues to be incidents involving fires and explosions on vessels less than 20,000 DWT carrying oil cargoes resulting in fatalities.

4 Guidance for the use of inert gas systems on oil tankers

The IMO inter-industry working group report and the OCIMF study found that flammable oil cargoes are carried more safely on oil tankers that have installed, and are effectively using, an inert gas system to maintain the cargo vapour space in an inert condition.

The enhanced safety associated with the use of inert gas systems outweighs concerns such as increased port turn-around time and issues associated with cargo segregation and product quality.

The safety benefits of inert gas in cargo tanks are well recognised throughout the tanker industry. Over the years many lives have been lost, or serious injuries sustained, due to incidents involving fires and explosions on non-inerted tankers transporting flammable oil cargoes. The installation of an inert gas system on oil tankers of all sizes that carry flammable oil cargoes is both technically and operationally feasible. The effective use of the system, allied with training and the application of correct procedures, prevents incidents involving fires and explosions in cargo tanks and will result in a significant safety performance improvement when carrying flammable oil cargoes on oil tankers.

In summary, OCIMF has concluded that oil tankers that carry flammable oil cargoes should be designed and fitted with a SOLAS compliant inert gas system.

- Operators of existing oil tankers not already covered by the SOLAS inert gas requirements should consider installing a SOLAS compliant inert gas system on those vessels during the vessel's next special survey/major refit.
- Existing oil tankers less than 20,000 DWT fitted with an inert gas system that is not fully compliant with SOLAS requirements should be operated in such a manner that cargo tanks are maintained in an inert condition.
- New oil tankers that are to carry flammable oil cargoes should install a SOLAS compliant inert gas system when the vessel is being built.

All vessels fitted with an inert gas system should maintain it fully functional, use it in accordance with ISGOTT guidance, and maintain cargo tanks in an inert condition at all times, except when it is necessary to be gas-free for tank entry.



A voice for safety

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