SUPER-LNG - SUstainability PERformance of LNG-based maritime mobility

Gap analysis and knowledge mapping on safety and security for LNG in ports

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LOSS PREVENTION 2019

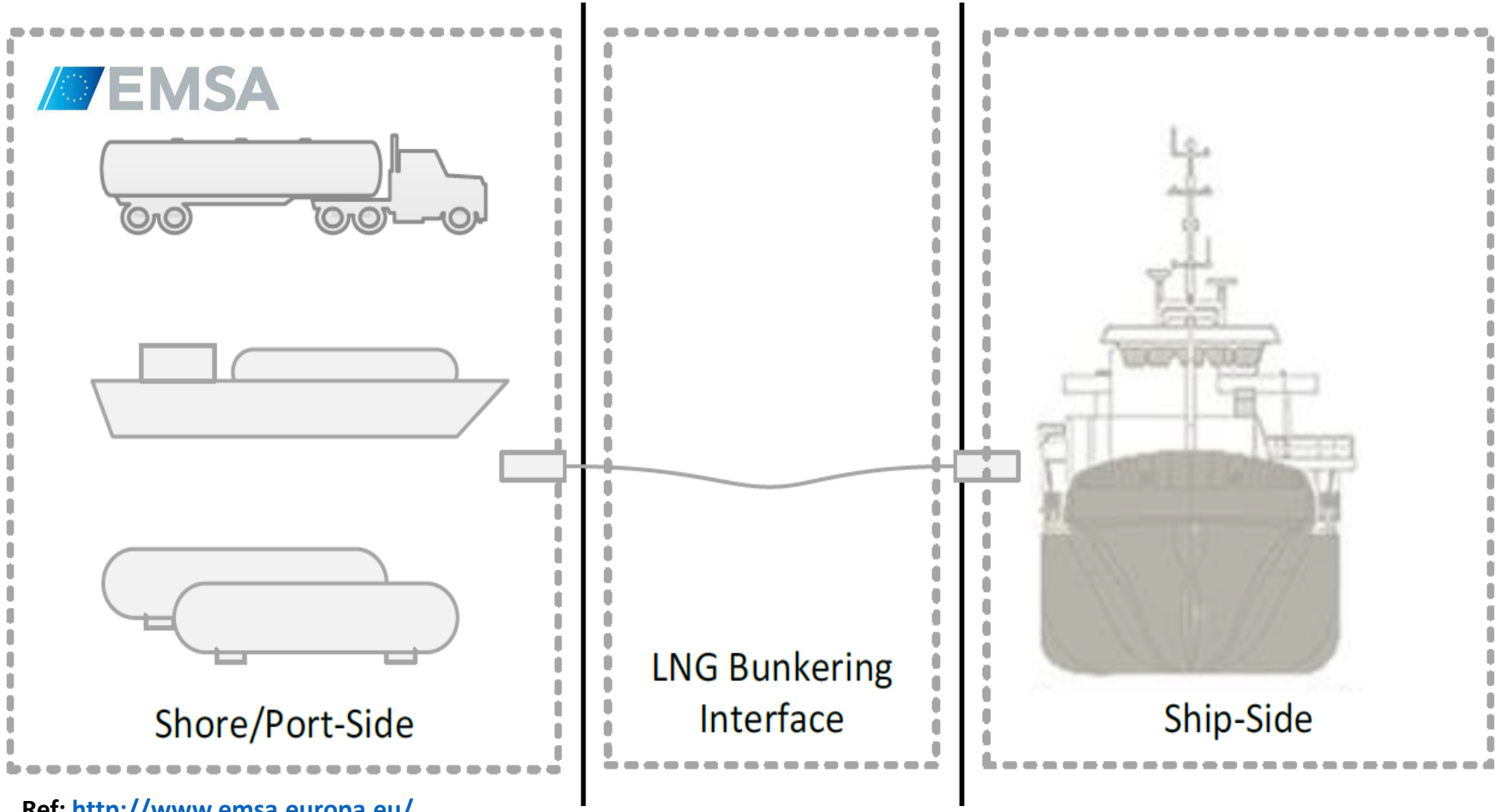
Outline

- Introduction
- High level Regulations
- Standards
- Class Regulations & Guidelines
- Comparative Analysis
- Literature Review
- Identified Gaps
- Conclusions

Ref: http://www.seatrade-maritime.com
Truck-to-ship LNG Bunkering at the port of Antwerp

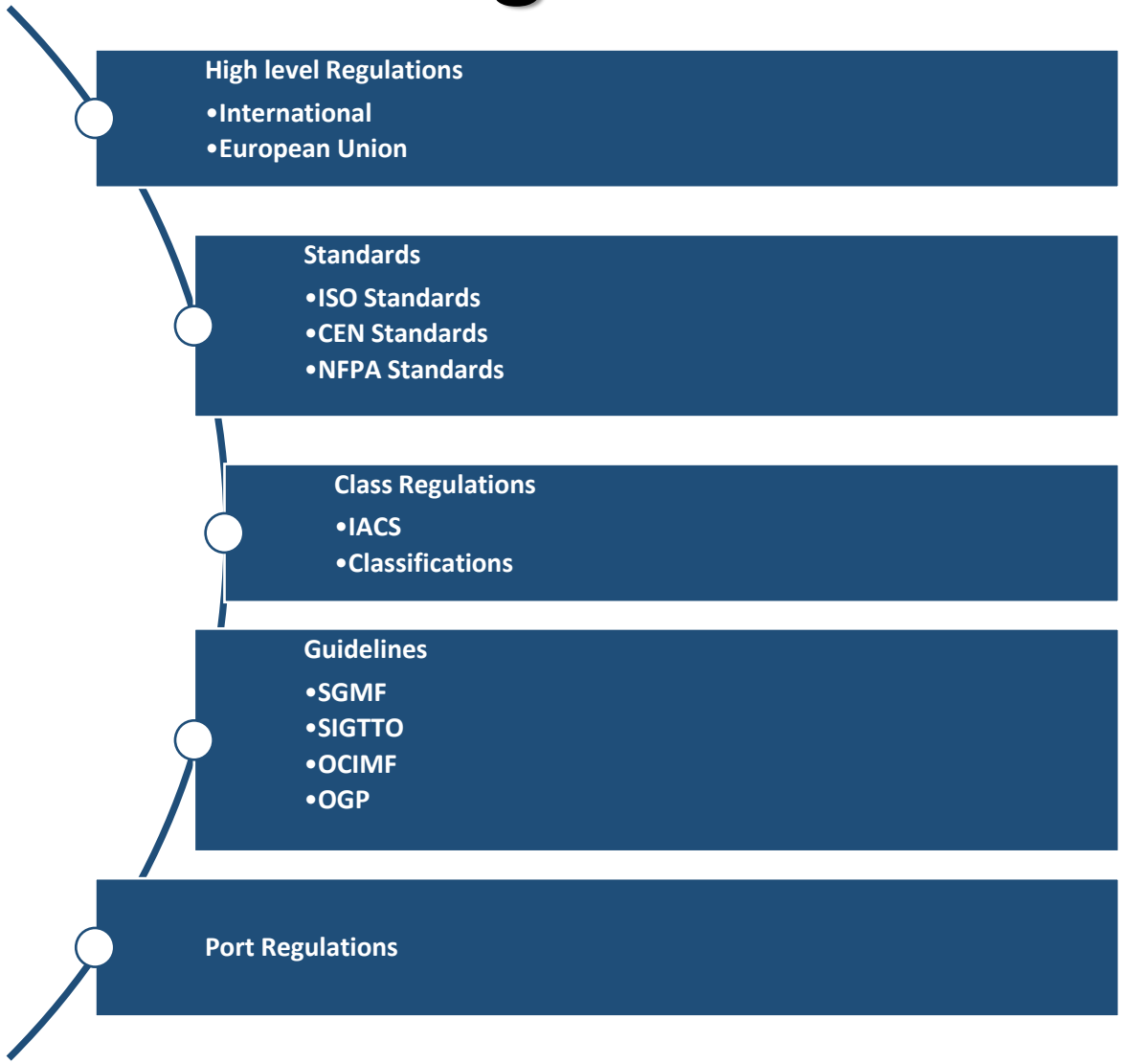
Ref: https://gcaptain.com
Ship-to-Ship LNG Bunkering at the port of Gothenburg

Ship to Shore LNG Bunkering

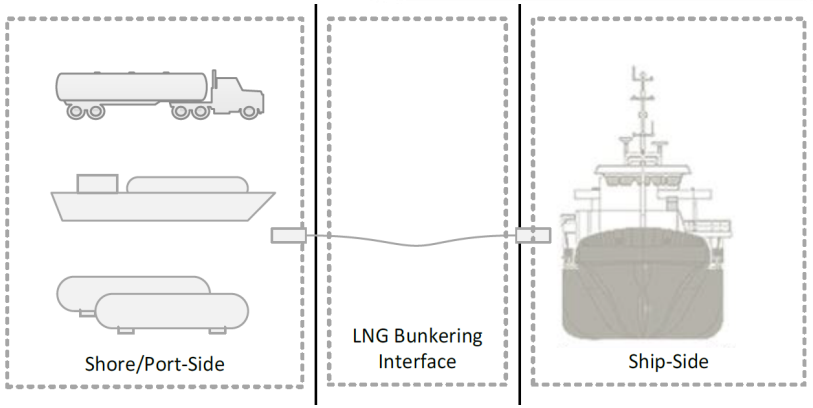


Ref: http://www.emsa.europa.eu/

Overview of Regulations



High Level Regulations



International

- International Convention for Safety of Life at Sea (SOLAS, 2009)
- International Code of Safety for Ships using Gases (IGF, 2015)
- International Code for the construction and equipment of ships carrying Liquefied Gases in bulk (IGC Code, 2014)

European

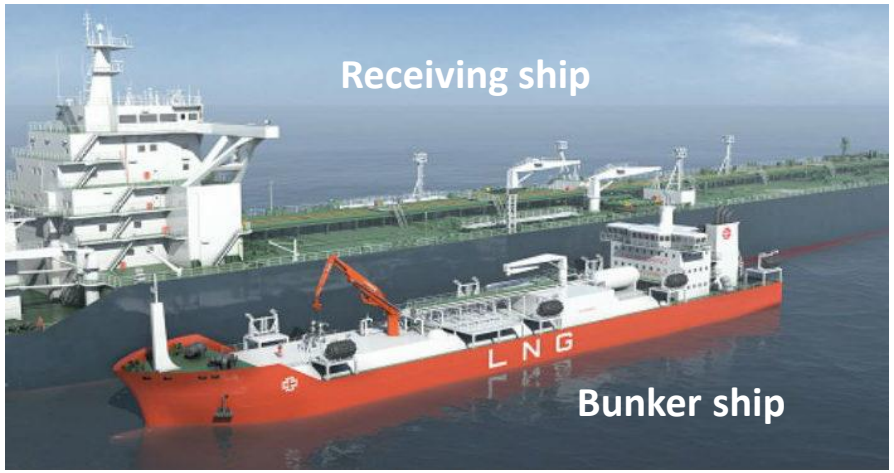
- Seveso III Directive (2012)
- ADR Agreement – International Carriage of Dangerous Goods by Road (2017)

Ref: http://www.emsa.europa.eu/

High Level Regulations cont'd

SOLAS Convention (2009)

- SOLAS is a set of international regulations first released in 1914, in consequence to the Titanic disaster.
- Today SOLAS regulates basic safety aspects for ships on international voyages such as construction, fire protection and lifesaving appliances, carriage of cargoes, oil fuel, dangerous goods and safety measures

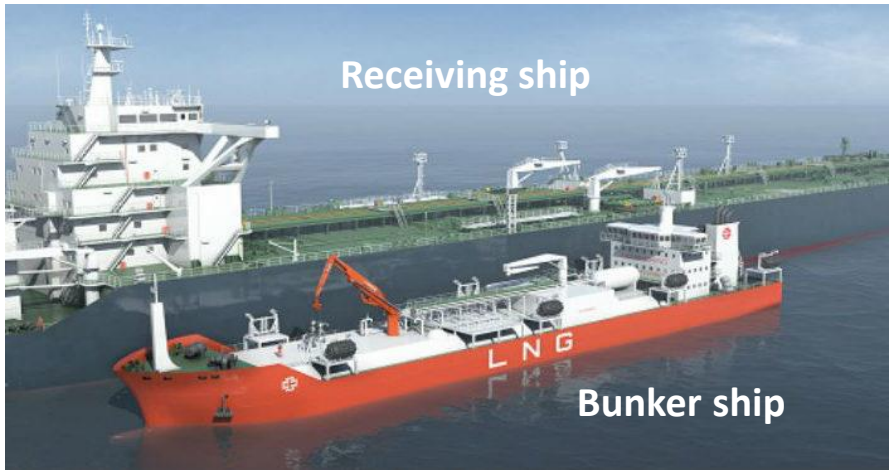


Ref: http://www.coherentchronicle.com

High Level Regulations cont'd

IGF Code (2015)

- Consists an international standard for ships using LNG as fuel.
- Provides mandatory provisions for the arrangement, installation, control and monitoring of machinery, fuel containment system, equipment and systems to minimize the risk to the receiving ship, its crew and the environment.

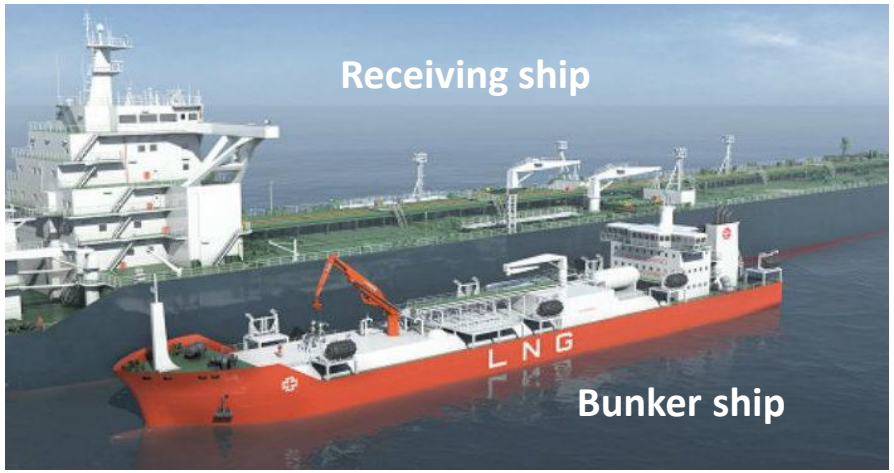


Ref: http://www.coherentchronicle.com

High Level Regulations cont'd

IGC Code (2014)

- Consists an international standard for ships carrying LNG as cargo.
- Is mainly for the construction and equipment requirements for LNG carriers.
- Provides requirements for gas bunker ships.



Ref: http://www.coherentchronicle.com

High Level Regulations cont'd

Seveso III- Directive (2012)

- Includes rules for the **prevention** of major accidents which involve dangerous substances, and the **limitation** of their consequences for human health and the environment.
- Requires a safety management system and emergency plan.

Ref: https://gcaptain.com
Harvey Gulf's LNG fueling facility at Port Fourchon

High Level Regulations cont'd

ADR International Carriage of Dangerous Goods by Road (2017)

- Contains packaging, labelling, of hazardous materials and construction, equipment and operation of cargo tank
- Includes operations in loading – unloading of LNG

Ref: https://www.portofhelsinki.fi
Truck-to-ship LNG bunkering at the Port of Helsinki

Standards

ISO 20519 Ships and marine technology - Specification for **bunkering** of liquefied natural gas fuelled vessels
ISO/TS 18683 Guidelines for systems and installations **for supply of LNG as fuel to ships**
ISO/TS 16901 Guidance on performing risk assessment in the design of **onshore LNG installations including the ship/shore interface**
ISO/TS 28460 Petroleum and natural gas industries -- Installation and equipment for liquefied natural gas -- **Ship-to-shore interface and port operations**

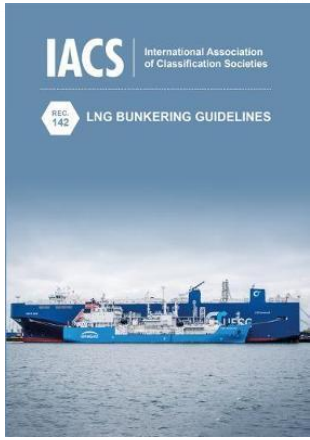
NFPA 59A Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG).

EN 1473 Installation and equipment for liquefied natural gas. Design of onshore installations.

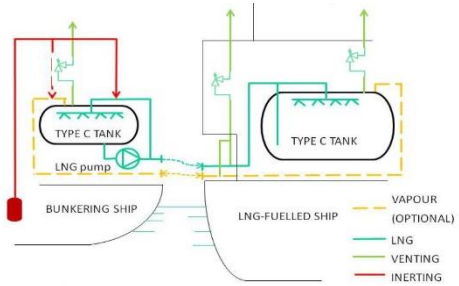
Class Regulations

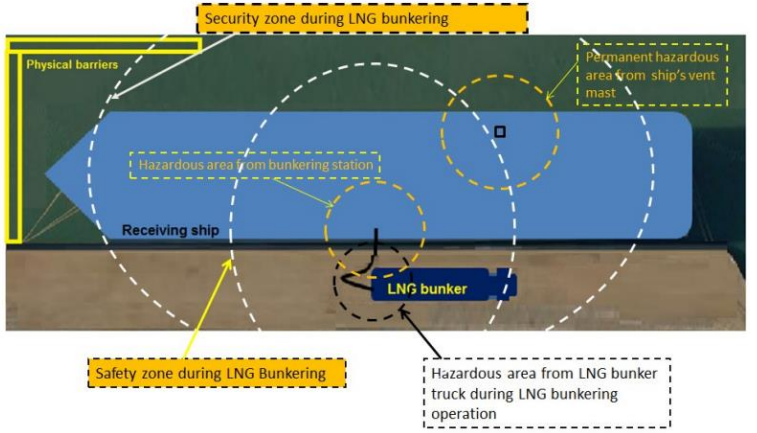
International Association of Classification Societies – **REC 142**

LNG BUNKERING GUIDELINES



- Bunkering methods
- The responsibility of different parties involved in the LNG transfer
- Technical requirements for bunkering systems
- Risk assessment on bunkering operations
- Functional and General Requirements for LNG bunkering operations
- Guidance on HAZID and HAZOP for LNG bunkering operations

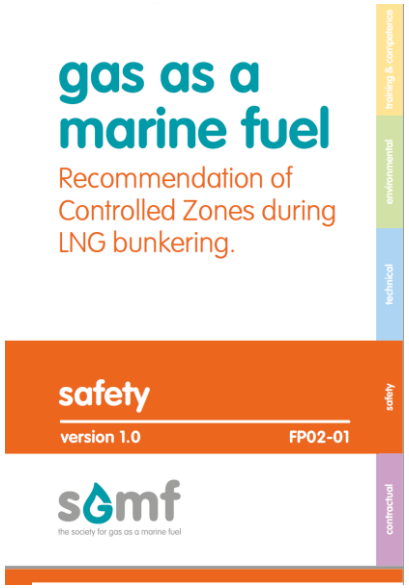




Guidelines

Society for Gas as Marine Fuel

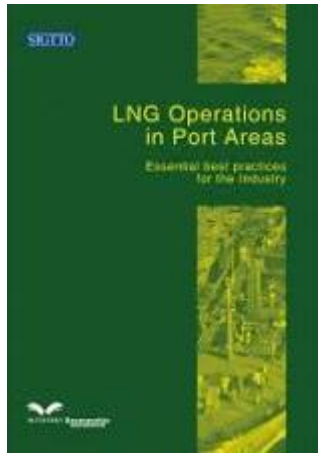
- **Bunkering safety guidelines** to ensure that LNG-fueled ships are re-fueled with the highest levels of safety, integrity and reliability (2017)
- Gas as a marine fuel. Recommendation of **Controlled zones** during LNG bunkering (2018) – Provides examples of calculating zones

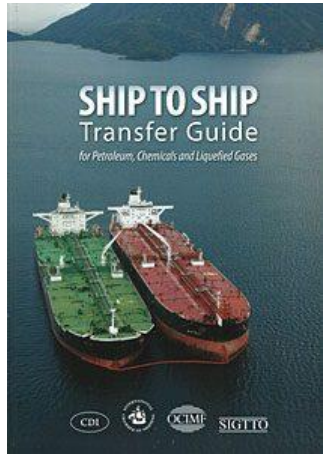


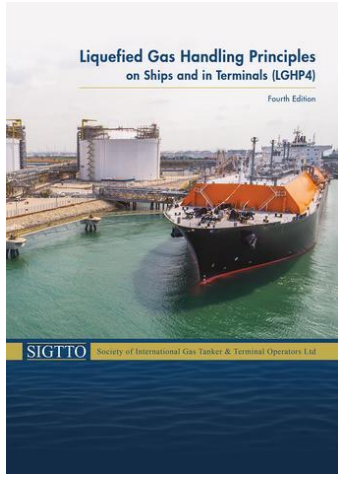
Guidelines cont'd

Society of International Gas Tanker and Terminal Operators

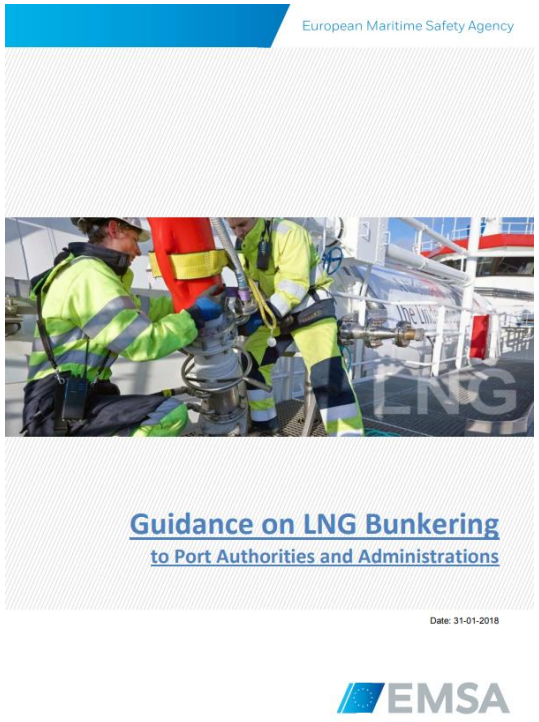
- Liquefied gas handling principles on ships and in terminals (2016).
- Guidelines on LNG ship to ship transfer guide for petroleum, chemicals and liquefied gases (2013).
- Best practices for LNG operations in port areas (2003).



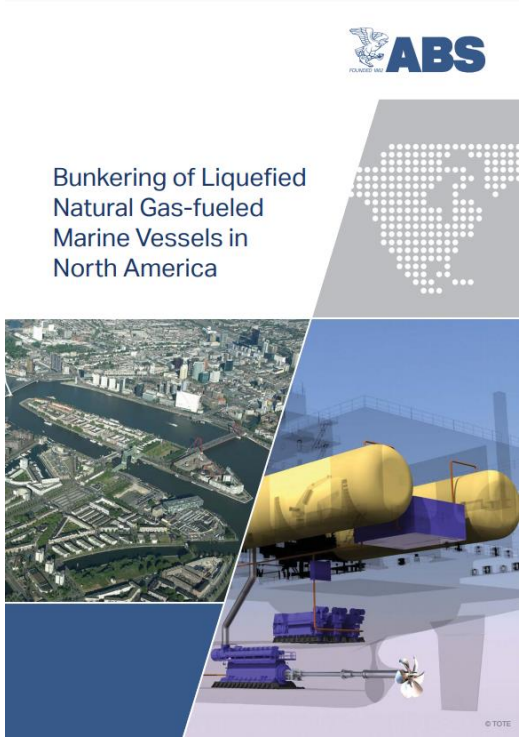




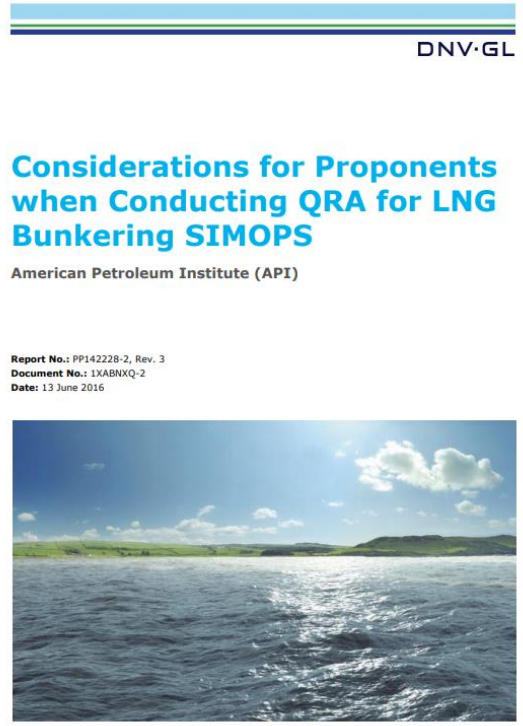
LNG Bunkering Reports



- ✓ Guidance on LNG bunkering to port authorities and administrations (EMSA, 2018)



- ✓ Bunkering of Liquefied natural gas-fueled marine vessels in north America (ABS, 2015)



- ✓ Considerations for proponents when conducting QRA for LNG bunkering SIMOPS (API PP142228-2 REV. 3)

Comparative Analysis

Tanks: SEVESO III, EN 1473, NFPA 59A

Truck-vehicle: SEVESO III, ADR, NFPA 59A

Bunker ship: IGC code, ISO 20519, ISO 28460

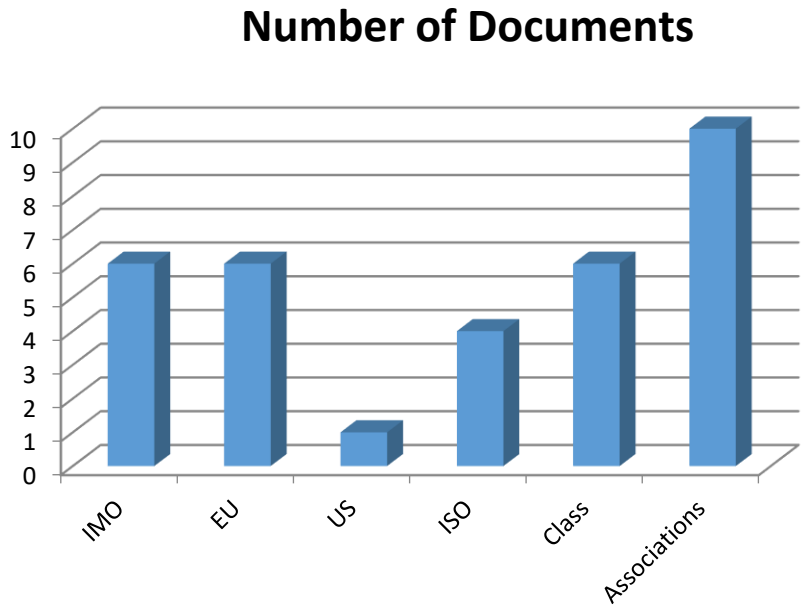
Bunkering: SEVESO III, ISO 18683, ISO 16901

ISO 20519, ISO 28460

Receiving ship: IGF code

Risk assessment: SEVESO III, ISO 18683

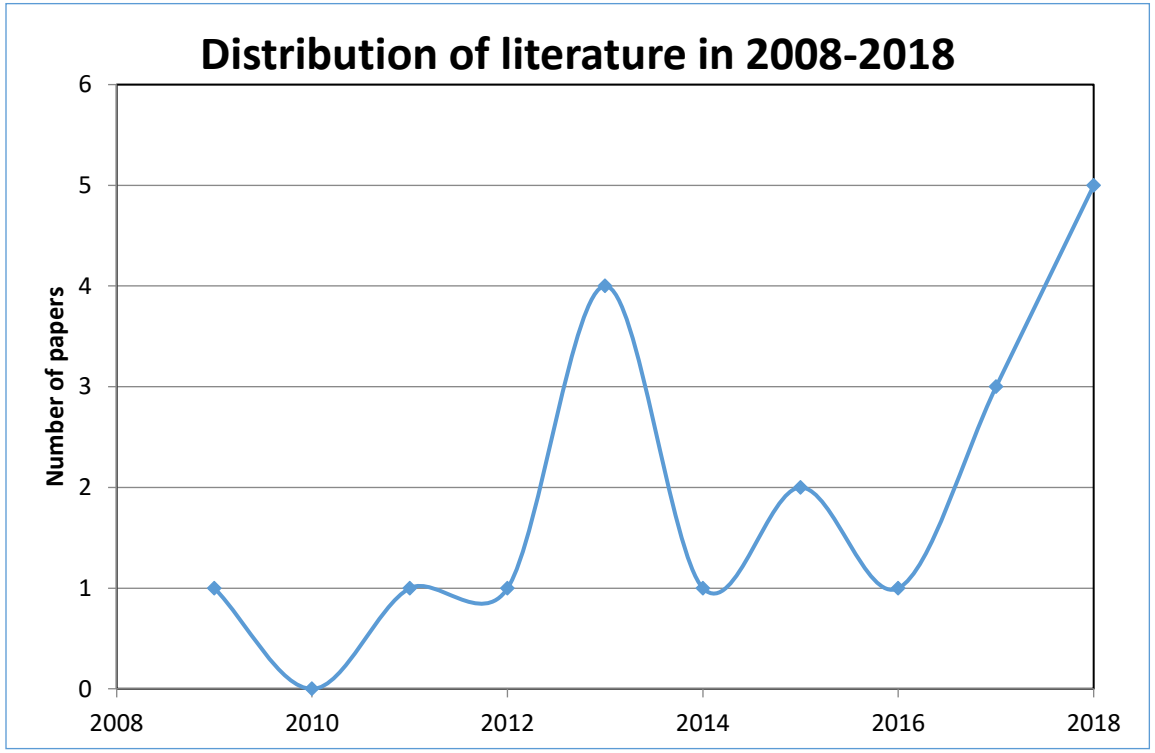
ISO 16901, ISO 20519, EN1473



Literature review

- Keywords “LNG”, “safety” and “port” (all required) were included in the title, summary, or keywords section of the database documents
- Keywords “LNG” and “port” were included in the title of the database documents
- Keywords “LNG” and “bunkering” were included in the title of the database documents

Literature data



RESEARCH AREAS

- LNG bunkering operations (7 docs)
- Small scale LNG facilities (2 docs)
- LNG at ports combined with the supply network (2 docs)
- Consequence assessment of LNG releases at ports (3 docs)
- Risk assessment for LNG storage and bunkering at ports (5 docs)

Identified Gaps

- Lack of harmonization of LNG safety regulations both at sea and on the land, for all LNG operations at ports namely, ship-fuelling, bunkering and LNG land facilities
- Lack of harmonization for LNG safety regulations within various countries across the world
- Lack of knowledge for estimating safety and hazardous zones during storage and bunkering of LNG, under various conditions

Conclusions

- Review on legislation, standards and guidelines regarding safety for LNG at ports.
- Literature review on scientific papers for safety at ports storing LNG.
- Identified Gaps regarding legislation and scientific knowledge.

Thanks for your attention

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