**2012 – 2015 Triennium Work Report**

**Chapter: Safety, Standards and Regulations**

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**Programme Committee D3: SMALL SCALE LNG**

**Chair: Wouter Meiring**

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# Introduction

*To be checked and completed*

Even if the diffusion of LNG along the Small Scale chains and networks is constantly growing all aover the world, in no country specific and complete Safety Standards and Regulations[[1]](#footnote-1) for the design, construction and management of LNG infrastructures have been fully developed and formalised[[2]](#footnote-2).

Far from meaning that this subject is not a priority for the LNG industry, this fact rather testifies the difficulty of fitting the complexity and variety of this new branch of the LNG business in a world already largely populated by the conventional fuels and their specific logistic infrastructures.

Some main barrier exist to the development of new Safety Standards and Regulations, as hereafter examplified:

* the cryogenic nature of LNG. LNG is the first and only cryogenic fuel offered to a large scale market and this implies very peculiar technical issues. For example, no other conventional fuel produces boil off.
* the international characteristics of the LNG market that leads to a need for “global” or at least “regional” Standard interfaces. An example is the birth of a new range of small to medium sized LNG carriers, some with pressurised tanks, other with conventional tanks. Both of them will need to dock at the same terminal, possibly the same of conventional large size LNG carriers. Another example is the need for universal standards and regulations necessary for the bunkering service of large ships.
* the difficulty of integrating new infrastructures into active areas, like ports, often congested, close to urban areas, therefore with possible safety issues, and usually already strictly regulated by local, national or even supra-national laws.
* the need to create a common awareness of the Small Scale LNG characteristics and potentialities between industrial subjects of different nature (suppliers, technology providers, users) and governmental entities. In addition, the number of experts that currently know how LNG can be safely transported, transferred, managed and stored on the Small Scale environment is limited if compared to the envisaged amplitude of the market and this doesn’t help a fast harmonization.
* the global nature of the Small Scale LNG development. In many countries pilot projects/initiatives have been developed with success. Each success tends to create local (sometimes “strictly local”) know-hows that can be conflicting with know-hows developed elsewhere. An example: screwed connectors for hoses are widely used but quick connect/disconnect connectors are also proposed to the market. Will the two standards coexists? Or the safer one should have to be prescripted for the future by international standards?
* since the potential of Small Scale LNG is not yet fully understood and defined, it becomes quite difficult now to define some of the necessary Standards and the required Regulations. For example, currently nobody is now providing bunkering service during navigation but this kind of operation is quite usual for conventional fuels: is there any need to start thinking to standards and regulations for this kind of transfer or not?

Many of the above mentioned barriers to the production of Standards and common Regulations are typical of any new development and hopefully will be cut down in the next years.

Some scattered and initial evolutions have anyway already started. They can be summarized in few lines:

* Development of local and national regulations in the forerunner countries
* Supranational/federal interest to create common standards and regulations
* Interest of certifying bodies in the development of specific guidelines and standards

*To be checked and completed*

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# Standards

Typically, the development of new standards and operative procedures, starts with a selection and adaptation of similar standards already of general use in the well developed large scale LNG industry or in some specific niche (for example, the LNG peak shaving plants).

A key importance can be attributed to the LNG terminals, that are becoming the hearth of the development of Small Scale LNG initiatives in the most advanced countries. In the past decades the diffusion of those plants has largely grown in all the continents, there allowing to local industries and to authorities a first contact with the LNG and building the first nuclei of knowledge. A similar role is fulfilled in the producing countries by the LNG liquefaction plants.

In this respect, organizations like *The Society of International Gas Carrier and Terminal Operators* (SIGTTO) and the relatively new born *Society for Gas as a Marine Fuel* (SGMF) have an important role in establishing a base level of harmonization.

Another important source of know-how and experience, if not directly of standards and procedures, are the industry of the cryogenic gas production and processing and, secondly, the wider world of the hazardous materials.

*Possible new structure*

Standards for general use in design and construction

Standards for operations

Guidelines for training

IMO rules

SIGGTTO guidelines

Other

*The following list has to be checked, integrated, cleaned and reduced.*

**NFPA 59A- Standard for the Production, Handling and Storage of Liquefied Natural Gas (LNG) 2013 edition**

This US National Fire Protection Association standard applies to the location, design, construction, maintenance and operation of all facilities that liquefy, store, vaporise and handle natural gas and deals with the training of personnel involved with LNG ([*http://www.nfpa.org*](http://www.nfpa.org)).

**EN 1473:2007 Installation and Equipment for LNG - Design of Onshore Installations**

This European Standard provides guidelines for the design, construction and operation of all onshore liquefied natural gas installations, including those for the liquefaction, storage, vaporisation, transfer and handling of LNG (*ISBN: 9 780 58050 229 3*).

**EN 13645:2002 - Installations and equipment for LNG – Design of onshore installations with a storage capacity between 5 t and 200 t**

This European Standard specifies requirements for the design and construction of onshore stationary LNG installations with a total storage capacity of between 5 t and 200 t. The installation is limited from the gas inlet or the loading LNG area to the gas outlet or the unloading LNG area. Filling systems are not covered.

*ISBN: 0 580 39202 3*

**Seveso III Directive EU Directive 2012/18/EU**

The Seveso Directive deals with the control of onshore major accident hazards involving dangerous substances. The current directive, Seveso III, entered into force in August 2012 and will become fully applicable in June 2015 ([*http://ec.europa.eu/environment/seveso*](http://ec.europa.eu/environment/seveso%20)).

**USCG - Guidance Related to Waterfront LNG Facilities – Including Information on Assessing the Suitability of Waterways for LNG Marine Traffic**

This circular provides guidance to an applicant seeking a permit to build and operate a shore side LNG terminal. It looks at the timing and scope of the process that is necessary to ensure full consideration is given to the safety and security of the port, the facility and the vessels transporting the LNG ([*http://www.uscg.mil/hq/cg5/nvic/pdf/2011/NVIC%2001-2011%20Final.pdf*](http://www.uscg.mil/hq/cg5/nvic/pdf/2011/NVIC%2001-2011%20Final.pdf)).

**Guidance on performing risk assessment in the design of onshore LNG installations including the ship/shore interface – ISO draft 116901** ([*www.ogp.org.uk/index.php/download\_file/view/408/2876/*](www.ogp.org.uk/index.php/download_file/view/408/2876/%20) ).

**BS EN 1160 1997 - Properties and materials for LNG (Being revised as an ISO - CD 16903)**

This International Standard gives guidance on the characteristics of liquefied natural gas (LNG) and the cryogenic materials used in the LNG industry. It also gives guidance on health and safety matters. It is intended to act as a reference document for the implementation of other standards in the liquefied natural gas field. It is intended as a reference for use by persons who design or operate LNG facilities.

*ISBN: 0 580 26446 7*

**Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents - API Recommended Practice 2003, 7th Edition**

Presents the current state of knowledge and technology in the fields of static electricity, lightning, and stray currents applicable to the prevention of hydrocarbon ignition in the petroleum industry and is based on both scientific research and practical experience. The principles discussed are applicable to other operations where ignitable liquids and gases are handled.

*http://publications.api.org/*

**EN 1474-1:2008 - Installation and Equipment for LNG – Design and testing of marine transfer systems – Part 1: Design and testing of transfer arms** (Being revised as ISO/DIS 16904)

This European Standard specifies the design, minimum safety requirements and inspection and testing procedures for LNG transfer arms intended for use on conventional onshore LNG terminals. It also covers the minimum requirements for safe LNG transfer between ship and shore. Although the requirements for remote control power systems are covered, the standard does not include all the details for the design and fabrication of standard parts and fittings associated with transfer arms.

*ISBN: 9 780 58057 033 2*

**7. EN 1474-2:2008 - Installation and Equipment for LNG – Design and testing of marine transfer systems – Part 2: Design and testing of transfer hoses**

This European Standard provides general guidelines for the design, material selection, qualification, certification, and testing details for LNG transfer hoses for offshore transfer or on coastal weather-exposed facilities for aerial, floating and submerged configurations or a combination of these. While this European Standard is applicable to all LNG hoses, there may be further specific requirements for floating and submerged hoses.

The transfer hoses will be designed to be part of transfer systems (fitted with ERS, QCDC, handling systems, hydraulic and electric components etc.)

*ISBN: 9 780 58057 977 6*

**29. BS EN 1474 Part 3 2008** - **Installation and Equipment for LNG Design and testing of marine Transfer Systems - Offshore transfer systems**

This European Standard gives general guidelines for the design of LNG transfer systems intended for use on offshore transfer facilities or on coastal weather exposed transfer facilities. The transfer facilities considered may be between floating units, or between floating and fixed units. The specific component details of the LNG transfer systems are not covered by this European Standard.

*ISBN: 9 780 58057 978 3*

**9. Energy Institute Model Code of Safe Practice Part 15: Area Classification Code for Installations Handling Flammable Fluids**

(formerly referred to as IP 15) EI 15 provides methodologies for hazardous area classification around equipment that stores or handles flammable fluids in the production, processing, distribution and retail sectors. It is a sector specific approach to achieving the hazardous area classification requirements for flammable fluids required in the UK by the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) 2002.

*ISBN: 9 780 85293 418 0*

**13. BS 4089:1999 Specification for Metallic Hose Assemblies for Liquid Petroleum Gases and Liquefied Natural Gases**

This British Standard specifies requirements and test methods for metallic hose assemblies used for the loading and unloading of liquefied petroleum gases under pressure.

NOTE: These hoses are primarily used for road and rail tankers or for ship to shore duties.

*ISBN: 0 580 33058 3*

**21. Bureau Veritas – ‘Safety Rules for Gas-Fuelled Engine Installations in Ships’ NR 529 (last edition May 2011)**

Applies to ships fitted with internal combustion engine installations using natural gas as fuel. The engines may use either a single fuel (gas) or dual fuel (gas and fuel oil), and the gas may be stored in gaseous (CNG) or liquid (LNG) state.

*http://www.veristar.com/content/static/veristarinfo/images/4707.9.529NR\_2011-05.pdf*

**22. EU ATEX Directives**

ATEX is the name commonly given to the two European Directives for controlling explosive atmospheres:

1) Directive 99/92/EC (also known as ‘ATEX 137’ or the ‘ATEX Workplace Directive’) is on minimum requirements for improving the health and safety protection of workers potentially at risk from explosive atmospheres.

2) Directive 94/9/EC (also known as ‘ATEX 95’ or ‘the ATEX Equipment Directive’) is on the approximation of the laws of Members States concerning equipment and protective systems intended for use in potentially explosive atmospheres.

*http://ec.europa.eu/enterprise/sectors/mechanical/atex/*

*http://ec.europa.eu/enterprise/sectors/mechanical/documents/legislation/atex/*

**24. Part 6 Chapter 13, Gas Fuelled Ship Installations, Jan 2012 – Det Norske Veritas**

This rule chapter includes requirements from the ship’s gas fuel bunkering connection up to and including the gas consumers. Has requirements for arrangement and location of gas fuel tanks and all spaces with gas piping and installations, including requirements to entrances to such spaces. Hazardous areas and spaces due to the gas fuel installations are defined. Requirements for control, monitoring and safety systems for the gas installations are included, plus additional monitoring requirements for gas engines and compressors.

*http://exchange.dnv.com/publishing/ruleshslc/2012-04/ts613.pdf*

**26. LNG Fire Protection and Emergency Response,** 2007 Edition **IChem E**

This booklet was written to improve understanding of the nature and hazards of LNG and the special fire hazards management and emergency response measures required for such facilities.

*ISBN: 9 780 85295 515 4*

**30. BS EN 60079-0 2009 Explosive Atmospheres**

This part of IEC 60079 specifies the general requirements for construction, testing and marking of electrical equipment and Ex-components intended for use in explosive atmospheres. Unless modified by one of the standards supplementing this standard, electrical equipment complying with this standard is intended for use in hazardous areas in which explosive atmospheres exist under normal atmospheric conditions of:

• temperature –20°C to +60°C;pressure 80 kPa (0,8 bar) to 110 kPa (1,1 bar); and

• air with normal oxygen content, typically 21 % v/v.

*ISBN: 9 780 58055 443 8*

**31. BS EN 60079-Part 29-2** **2007 Explosive Atmospheres Gas detectors – Selection installation, use and maintenance of detectors for flammable gases and oxygen**

This part of IEC 60079-29 gives guidance on, and recommended practice for, the selection, installation, safe use and maintenance of electrically operated group II apparatus intended for use in industrial and commercial safety applications for the detection and measurement of flammable gases, complying with the requirements of IEC 60079-29-1.

This standard applies to apparatus, instruments and systems that indicate the presence of a flammable or potentially explosive mixture of gas or vapour with air by using an electrical signal from a gas sensor to produce a meter reading, to activate a visual or audible pre-set alarm or by other device, or by any combination of these.

*ISBN: 9 780 58054 363 0*

**32. BS EN 12567: 2000 Industrial valves- Isolating valves for LNG – Specification for suitability and appropriate verification tests**

This European Standard specifies the general performance requirements of isolating valves (gate valves, globe valves, plug and ball valves and butterfly valves) used in the production, storage, transmission (by pipeline, rail, road or sea) of LNG.

*ISBN: 0 580 36423 2*

**1. ISO 28460:2010 – Installation and equipment for LNG Ship-to-shore interface and port operations**

Specifies the requirements for ship, terminal and port service providers to ensure the safe transit of an LNG carrier (LNGC) through the port area and the safe and efficient transfer of its cargo. It is applicable to:

• Pilotage and vessel traffic services (VTS)

• Tug and mooring boat operators

• Terminal operators

• Ship operators

• Suppliers of bunkers, lubricants and stores and other providers of services while the LNGC is moored alongside the terminal.

This International Standard applies only to conventional onshore LNG terminals and to the handling of LNGCs in international trade.

*ISBN: 9 780 58065 735 1*

**5. IMO Revised Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas**

These Recommendations set out a framework within which legal requirements can be prepared by Governments, whether for the first time or as a revision, to ensure the safe transport and handling of dangerous cargoes in port areas. There commendations do not specify standards of construction and equipment.

*ISBN: 9 789 28011 472 0*

**9. BS 4089:1999 - Specification for Metallic Hose Assemblies for Liquid Petroleum Gases and Liquefied Natural Gases**

This British Standard specifies requirements and test methods for metallic hose assemblies used for the loading and unloading of liquefied petroleum gases under pressure.

NOTE: These hoses are primarily used for road and rail tankers or for ship to shore duties.

*ISBN: 0 580 33058 3*

**22. LNG Bunkering Safety Checklists – IAPH**

Three documents are currently in draft form for:

• Truck to ship

• ship to ship

• shore to ship LNG bunkering.

The final documents should be available in November 2013. These checklists will be made available on the WPCI LNG Fuelled Vessels website and can be requested by sending an email to tessa.major@portofantwerp.com

**23. ISO 10976 Refrigerated Light Hydrocarbon Fluids – Measurement of cargoes on board LNG carriers**

This International Standard establishes the steps to properly measure and account for the quantities of cargoes on LNG carriers including, but not limited to, the measurement of liquid volume, vapour volume, temperature and pressure and accounting for the total quantity of the cargo on board.

It describes the use of common measurement systems used on board LNG carriers, the aim of which is to improve the general knowledge and processes in the measurement of LNG for all parties concerned. It also provides general requirements for those involved in the LNG trade on ships and onshore.

**1. STCW Convention – IMO**

The Convention prescribes minimum standards relating to training, certification and watchkeeping for seafarers which countries are obliged to meet or exceed.

*ISBN: 9 789 28011 528 4*

**3. LNG Shipping Suggested Competency Standards – SIGTTO**

This document has been prepared for the guidance of ship owners and operators who may be entering LNG ship operation for the first time.

It highlights the statutory requirements for training LNG tanker crews and the provisions of STCW, as it applies to gas tankers.

It also provides advice on the application of the ISM Code to the training and management of tanker crews.

*ISBN: 9 781 90533 136 9*

**7. Competence Related to the On Board Use of LNG as Fuel – DNV**

The standard identifies a suggested minimum level of knowledge and skills for people in various roles on board a vessel using LNG as fuel. This standard can be used in the following ways:

• As a reference to familiarise or assess people in their specific role in relation to LNG

• as a reference for global competence and defining training requirements

• as a guide to training providers, who are to develop courses according to the requirements of the standard and needs of the industry

• as a reference document for e.g. certification of personnel.

*http://exchange.dnv.com/publishing/stdcert/2013-04/standard3-325.pdf*

# Regulations

*To be checked and completed*

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Here below are some snapshots from different countries and regions of the world, of the status of regulations[[3]](#footnote-3).

*To be checked and completed*

**CARIBBEAN&CENTRAL AMERICA**

In general terms, most of the countries with potential projects don’t have a specific regulation for LNG receiving terminals. In order to attract investors for developing receiving terminals the regulatory framework needs to be defined. Notwithstanding, many of the projects under study count with those countries authorities’ support.

**ASIA**

**China**

Regional Regulatory Design Basis – Examples

GB50183 - Code for fire protection design of Petroleum and natural gas engineering

GB50016 - Code of Design on Building Fire Protection and Prevention

GB 16297 - "Integrated Emission Standards of Air Pollutants".

GBZ 1 - Hygienic Standards for the Design of Industrial Enterprises

GB/T 20438 - Functional Safety of electrical/ electronic/ programmable electronic safety-related systems

GB/T 21109 - Functional Safety – Safety instrumented system for the process industry sector

**France**

**India**

**Iran**

**Thailand**

In Thailand both a conventional LNG Terminal, located in Map Ta Phut and a Small Scale LNG liquefaction plant are operated. The Small Scale LNG plant has been developed in order to valorize associated gas produced locally, answering to a requirement of emissions reduction.

The Small Scale LNG plant is following the same international safety standard and Thai government regulations of the Map Ta Phut LNG terminal. For instance, in both the plants government officers attend one time per year, firefighting drills.

**EUROPE**

**Belgium**

**Finland**

**Germany**

**Italy**

In Italy the Ministry for the Economic Development is leading the constitution of a national Strategic Plan with the support of other ministries and the main national industry organizations. The plan shall include, among other aspects, the definition of a specific regulatory framework for the development of a complete LNG distribution infrastructure network; a specific law and the necessary application rules are expected to be in force in 2015.

**The Netherlands**

The Netherlands has been recently one of the most active country in promoting the new business area of Small Scale LNG. The interest has gradually grown since 2007, when Gate LNG, a project for the realization of the first Dutch LNG Terminal, located in Rotterdam, was sanctioned. The terminal was ready to operate in 2011. The physical presence of LNG in the country has led to many initiatives in the area of Small Scale LNG, like the *“Wadden and Rhine Green Deal”* an national act that in 2012 led to the constitution of the **“Nationaal LNG Platform”,** an operating body where governmental authorities and national economic and technical operators meet in order to agree a coordinated policy. The platform has also connections with other bodies outside the country. The main target of the Nationaal LNG Platform” is the so-called **“50/50/500”**: by the end of 2015, in the Netherlands and in the neighboring countries shall be operative at least 50 ships, 50 river barges and 500 trucks utilizin GNL as a fuel.

This ambitious target is leading to the need for additional standards and regulations to complement those ones already laid down and applicable in the national legislation or based on the European directives and rules. For instance, two guidelines where published in 2013 and 2014 that shall lead in permitting LNG delivery installations (both for vehicle and ship installations) and contain regulations that should be used by all authorities and also complied with by constructors and operators[[4]](#footnote-4). Besides, in the Netherlands legislation has been improved in order to enable LNG bunkering operations, ship-to-ship, both for river barges in Seinehaven and for ships in the Port of Rotterdam.

**Spain**

**Turkey**

**NORTH AMERICA**

**United States of America**

# Conclusion and recommendations

*To be checked and completed*

*Target: to develop and enforce regulations that can be uniformly adopted in the world.*

*Encourage for instance ISO standards development*

*Keep high the safety level of LNG industry even through Small Scale*

*Continue guaranteeing the protection of the environment while promoting a new “green” fuel*

1. In this chapter only Regulations referred to Safety and Environmental aspects are considered. No reference to commercial regulations is here discussed. For sake of clarity, it has to be noted that the boundaries of .the current report do not include the more downstream “leg” of the overall Small Scale LNG chain, that are the distribution and the final uses of LNG. [↑](#footnote-ref-1)
2. This statement to be considered valid at the date this part of the report was finalised (Sept. 2014). [↑](#footnote-ref-2)
3. At the date this part of the report was finalised (Sept. 2014). [↑](#footnote-ref-3)
4. The guidelines are downloadable at the following links: <http://www.publicatiereeksgevaarlijkestoffen.nl/publicaties/PGS33-1.html>

   http://www.publicatiereeksgevaarlijkestoffen.nl/publicaties/PGS33-2.html [↑](#footnote-ref-4)