KEYWORDS: ECA, safety, LNG, marine fuels, bunkering

ABSTRACT

Widespread use of LNG as a marine fuel requires and infrastructure for fuel supply and internationally accepted guidelines for the bunkering process. On this basis an ISO work group has been started to develop guidance on how to meet safety requirements specified by authorities (National and Port). Reference to Guidelines for Risk Assessment. Establish operational and control procedures to ensure safe, practical and aligned operations in different ports. Identify requirements to components (Storage tanks, piping, hoses, loading arms, connectors etc) to ensure equipment compliance other factors such as requirements for maintenance, training and qualification schemes, emergency preparedness. The work group shall collect, evaluate and distill experiences and practices developed in the North Sea area with a focus to standardize the interface between the ship and the fuel supply facilities, to ensure that a LNG fuelled ship can refuel in any port with LNG fuel supply facilities This paper will present the status and preliminary results from this work. The proposal is presented on the assumption that the content is approved by ISO and the members of the work-group.

INTRODUCTION / BACKGROUND

Shipping is an international business and has, so far, not been heavily regulated with regard to air emissions. But increased focus on environmental emissions is materializing as new requirements in designated Environmental Control Areas (ECA) in the Baltic/North Sea and North America. These new requirements will be enforced through UN’s International Maritime Organization (IMO) as part of the regulations for the Maritime Industry from 2015 and 2016.

Limits on emissions of Sulphur Oxides (SOx) will require reduced sulphur content in the fuel and this will cause the most immediate concern for ship owners. Several studies predict the resulting increased cost of ship transport to be significant and in the range of 10-50% within ECAs after 2015. Stricter limits for Nitrogen Oxides (NOx) emissions for ships built after 2016 will further add to the costs of ship transport, as exhaust gas cleaning systems today seems like the only solution for conventional engines.

These new requirements will indisputably have a significant impact on the short sea shipping segment in Northern Europe and North America, but also international ship transport originating or terminating within these areas.

The options for the shipping industry to meet the new requirements for sulphur emissions are:

- Switch to low sulphur fuel
- Install exhaust gas scrubbers
- Switch to natural gas as fuel

The requirements for NOx reductions that will be enforced in 2016 will require installation of Selective Catalytic Reactor (SCR) for the oilied fueled vessels. This is not required for the NG fuelled engines which will meet the NOx requirements.
The ship industry is gradually acknowledging that natural gas fueled engines fed by liquefied natural gas (LNG) can prove more cost efficient than scrubber technology, and in fact, also more cost efficient than current operation on heavy fuel oil. It is recognized that switching to LNG fuel, will be ECA compliant and technically feasible. This is supported by more than 10 years of successful operational experience using LNG in coastal shipping in Norway.

A deciding factor for the implementation of LNG as a marine fuel will be the availability of LNG. The LNG supply solutions that have been provided in Norway are tailored for the specific ships, and will not necessarily meet the requirement for a standard supply solution as required by international shipping.

The regulatory basis supply of LNG as a marine fuel is determined by local regulations for the port and at the requirements and systems on the receiving ships. Regulations for shipping, as an International Industry, are endorsed through IMO, and implemented as part of the flag regulations, while national regulations will apply for the local requirements in Ports.

It was realized that a significant growth in the fleet of LNG fueled ships would require aligned and standardized supply solutions. This can be implemented with an internationally agreed practice on how to design and operate LNG bunkering solutions in order to establish a standardized bunkering interface aligned to the requirements for the ship and at the same time meet the local regulations.

In this situation a proposal was presented to ISO TC67 WG10 to establish a new project with the aim to develop a new ISO document bridging local onshore regulations with the global and IMO anchored requirements for LNG fueled ships; the IGF Code.

ISO TC67 approved the proposal in January 2011 provided that more than 5 countries supported the initiative, and it was concluded in March 2011 that sufficient numbers of participants had signed up and that the work should be started. The work is now in progress.

OBJECTIVES OF THE PAPER

The objectives of this paper are to present the status of the work and to give an outline of the future ISO document. It is presented now as it is considered important to provide early information as several projects are in the starting blocks ready to move ahead and need guidance and alignment.

The work is in progress and detailed contents cannot be released at the present state. More details can be given in the presentation, provided that the workgroup reaches agreement in coming meetings.

DEVELOPMENT OF THE ISO GUIDANCE DOCUMENT

The Kick Off meeting was arranged in June 2011 with 14 participants. Now, after 9 meetings the group has grown to 35 members representing 15 countries, 8 oil, gas and energy companies, 2 regulators, 3 shipping companies, 7 equipment providers and Sigtto and 3 class societies.

The work was organized as part of ISO TC67, WG10. In the spring 2012, it was announced that the members representing oil companies temporarily would withdraw from ISO work due to political issues. The work continued organized under OGP (International Association of Oil & Gas Producers) to ensure continuity and avoid delays. The situation is now resolved, and the work will be finalized as an ISO project.

It is expected that a committee draft will be ready 2nd quarter, 2013.

The title of the ISO document is:

Guidelines for systems and installations for supply of LNG as fuel to ships.
The following **objectives** for the document have been defined:

- Ensure safety to personnel (crew, bunkering operators and 3rd party personnel)
- Minimize/eliminate release of Natural Gas to the atmosphere
- Promote standardization in equipment (connectors and instrumentation) and procedures.
- Give functional requirements to explain principles and allow for future improvements and developments by not prescribing existing solutions based on current and limited experience
- Allow for an effective review and permit process of simple and standardized solutions.

The document is still being developed but it will:

- Be a high level document outlining main principles and functional requirements.
- Define the procedures to design, install, operate and maintain the bunkering loading facility with regard to safety aspects and environmental conditions
- Give guidance on how to promote standardization of the interface between the LNG supplier and the ship both with regard to operations and hardware as an effective safety measure
- Give guidance for the use of risk assessment as part of the design and planning process.

The document will be in the format of an **ISO Technical report** with the following **Table of Contents**:

1. Scope
2. Normative references
3. Terms and definitions.
4. General principles and bunkering scenarios
5. LNG Characteristics
6. Safety approach
7. Risk assessment
8. Functional requirements for LNG Bunkering system
9. Requirements to systems and components
10. Training
11. Requirements to documentation

The document will primarily address the requirements for the following **three bunkering scenarios**:

1. Truck to ship
2. Tank to ship
3. Ship to ship.

Normally bunkering shall not coincide with cargo or passenger operations.

Other scenarios may be applied, but will require a more stringent risk assessment as part of the design and review process.

The document will address all equipment between the supplier shutdown valve and the presenting flange on the ship as outlined in fig 1.
In addition the document also will address the necessary information exchange between supplier and ship in order to ensure a safe operation.

The document will explain the key characteristics and differences between LNG and other marine fuels and will give reference to other relevant codes and regulations.

The main requirements to the bunkering system are presented as a number of **functional requirements**. Examples of these are listed below.

**Examples of functional requirements**

- The compatibility between supplier and ship shall be checked and documented prior to bunkering operations.
- The system shall be arranged so that the system can be commissioned and operated (purged and inerted) without release of LNG or natural gas to the atmosphere.
- LNG transfer shall be carried out in closed systems where the components are connected and leak tested before LNG transfer is started.
- The design shall reflect the required operational envelope (motions, weather, visibility).
- Operating procedures shall be established and documented and include a checklist to be completed and signed by both parties prior to the commencement of bunkering.
- All systems and components shall be maintained and tested according to, as a minimum, vendor recommendation to maintain their integrity.
- An organizational plan shall be prepared and implemented in operational plans and reflected in qualification requirements. The plan shall describe roles and responsibilities for the ship crew and bunkering personnel and communication lines and language for communication.
- The likelihood of igniting potential LNG releases shall be minimized. This is accomplished by elimination of ignition sources in classified areas and by controlling activities in the proximity of the bunkering operation.
- Elimination of the potential spark or high currents from static or galvanic cells when the bunkering system is connected or disconnected.
- The transfer operation shall be capable of being stopped safely and effectively without release of liquid or vapour.
- The transfer system shall be provided with an ERS (emergency release system) or breakaway coupling, to minimise damage to the transfer system in case of ships drift or vehicle movement. This should be designed for minimum release of LNG if activated. The ERS may be linked to the ESD system (where this may be referred to as ESD 2).
• The release of LNG or cold vapour should not lead to an escalation due to brittle fractures of steel structure

• Personnel shall use PPE (Personnel protective equipment) as appropriate for the operations.

• A safety zone shall be implemented around the bunkering operation into which only essential personnel shall have access.

• Activities in the area adjacent to the bunkering operation shall be controlled to reduce possible ignition sources.

• A contingency plan shall be in place outlining the requirements for:-
  o Evacuation of personnel and 3rd parties
  o Mobilising firefighting
  o Mobilising first aid, hospitals and ambulances
  o Communication to authorities

• Copies of the plan shall be communicated to all parties involved in the bunkering operation including the planned emergency response team and be part of the training program.

The normal approach for planning, review and acceptance of a bunkering facility shall be:

1. Document and describe equipment and operations
2. Determine safety distances based on dispersion assessment of largest credible release
3. Perform a HAZID and a qualitative risk assessment to identify potential safeguards and demonstrate acceptability (The risk acceptance criteria for the HAZID will be represented by a recommended Risk Matrix.)
4. For bunkering scenarios not meeting all functional requirements, or deviating from the standard scenario, a detailed quantitative risk assessment shall be carried out. (The risk acceptance criteria for the quantitative risk assessment shall be aligned with criteria for similar activities being advised by regulators. A proposal will be given, but regulator and operator may require stricter criteria.)
5. Implement all agreed safeguards and verify that components and systems are in agreement with recognized standard.

The document will also:

1. Provide reference to recognized standards for design, fabrication and use of components and systems.
2. Specify competence requirements for crew and shore personnel with reference to the qualification schemes already in place.
3. Specify requirements to documentation.

WAY AHEAD

The development of the high level requirements for LNG Bunkering is close to completion, and a draft document is expected to be ready in the 2nd quarter this year. When the committee has reached agreement a draft document can be distributed. It is expected that more details may be released during the presentation of this paper.