SAFETY & TRAINING ISSUES FOR LNG FUELLED VESSELS IN PORTS

David Haynes, Principal Technical Advisor
Who are SGMF?

• The Society for Gas as a Marine Fuel is
  • A non-governmental, non-profit making, membership based organization
  • Objective is to establish and encourage the safe and responsible operation of gas fuelled vessels and their fuelling infrastructure
  • SGMF is developing and delivering best practice and guidance on most aspects of the gas fuelled industry avoiding duplication and where it matters most

  TECHNICAL
  SAFETY
  ENVIRONMENTAL
  CONTRACTUAL
  TRAINING & COMPETENCE

• Took over responsibility for gas as a fuel from SIGTTO in 2013
  • SGMF + IGF code = gas as fuel
  • SIGTTO + IGC code = gas as cargo

• 95 members worldwide from a wide range of industries
• Including ship owners and managers, LNG suppliers and facility operators, bunkering providers, equipment manufacturers, port and National Authorities and consultants/designers
Essential Components Working Group

- Working group looking at the main components of the bunkering manifold area
- Chaired by Joel Fusey, FMC Europe
- Writing best practice and standardisation for
  - Manifold strength and layout
  - ESD system
  - Break away connectors
  - Couplers and connectors for hoses and hard arms
- Two meetings to date
Quantity & Quality Working Group

- Working group looking at how quantity and quality can be measured to determine custody transfer arrangements
- Chaired by Claudia Beumer, Emerson Process
- Writing best practice for
  - Tank sounding, weighbridge measurement and mass Coriolis and ultrasonic flow meters for LNG
  - Sampling or LNG and analysis of gas samples
  - Fuel parameters requiring assessment
  - Overview of potential contract requirements
- Three meetings to date
- Final proofs under review
- Guide anticipated to be published in October 2015
Bunkering Safety Guide

- Working group looking at how a safe bunkering process takes place
- Chaired by Claudia Beumer, Emerson Process
- Published best practice on LNG bunkering including
  - Overview of LNG and gas hazards
  - Overview of the bunkering process
  - Checklists (with IAPH)
- Published in January 2016
- Under review and will be republished in IACS guidelines
Safety Distances

- Working group looking at how to determine safety distances during bunkering
- Group members about to be invited to join
- Best practice on
  - Hazardous areas (for EX equipment)
  - Determining safety distances for both deterministic and probabilistic methods
  - Advice on security zones
- 3 meetings planned
- Hope to publish in summer 2016
Salvage Working Group

- Working group looking at how to salvage a LNG fuelled ship following an accident
- Chaired by Andrew brown, Smit Lamalco
- Investigating hazards and operating procedures to salvage a gas fuelled ship that
  - Is floating with LNG in storage
  - Is partially submerged
  - Has sunk
- Has been adapted to be an industry JIP
- Experimental programme initiated with TNO
- Preliminary guidance by end 2015
- Further work programme being explored
Training & Competence Working Group

- Working group looking at training and competency requirements
- Chaired by Ray Gillett, GTT Training
- Aims to develop
  - Competency guidance (by end 2015)
  - Assessment methods to ensure competence (2016)
  - Accreditation options
- Three meetings so far, next meeting end September 2015

- Working Group consists of
  - Professional training companies
  - Ship owners and operators
  - Terminal operating companies
  - LNG suppliers
  - Equipment manufacturers
  - Consultants involved in the LNG trade
SGMF’s aims in Training & Competence

• To encourage responsible (safe and environmentally sound) bunkering activities worldwide

• To suggest minimum and consistent standards for training and competence of all those involved in bunkering including
  • Mariners
  • Port authorities and their workers
  • Regulatory authorities

• To understand and promote best practice
What is training?

- Training is an activity that involves the teaching a particular skill or way of doing something.
- Generally, it does not require the trainee to have a particularly high level of understanding of the activity.

“Helping people to learn
• how to do something,
• telling people what they should or should not do or
• simply giving them information
Training isn’t just about formal “classroom” courses”

UK Health & Safety Executive
What is competence?

- Competency is often defined as being capable of undertaking a task and completing it successfully with confidence and understanding.

- Competency generally consists of the integration of one or more of:
  - Training;
  - Physical skills;
  - Underpinning knowledge;
  - Experience and
  - Understanding of the
  - task at hand;
  - surrounding environment; and
  - range of human factors.

“"I hear and I forget. I see and I remember. I do and I understand’’,

Confucius

The Engineering Council (UK) defines competence as:
“the integration of knowledge, understanding, skills and values”.

Engineering Council
Training for IGF Code

**IMO HTW Convention**
- Proposed maritime standard
- Draft list of learning areas available and model course under development
- Will not be enforced until 2017
- Only applicable to international shipping

- Model Course will define the HTW syllabus more fully suggesting
  - High level training requirements
  - Possible course plans
  - Training equipment to support learning
  - Likely data sources

**DNV GL**
- System currently used in Norway
- Looks at whole IGF Code ship
- Primarily Equipment based but some processes
- Mixture of background knowledge and competency
- Course syllabus about to be updated and re-released
Who is involved?

Bunker Vessel’s Master or Terminal Superintendent

Q&Q Specialist

Onshore operator

Hose watch

Manifold watch

Vessel’s Engineer

Vessel’s Master

Port/ship worker or visitor

Emergency services

Local/port authority representative

This is not just about mariners
## Who needs training?

**Individuals directly and indirectly involved in bunkering**

- Crew of the gas/LNG fuelled (receiving) vessel
- Personnel involved in the supply of the LNG
- Personnel involved in the delivery of the LNG such as road tanker drivers or the crew of a LNG bunker vessel.
- Port staff, both managerial and dockside, for example stevedores, tug crews and crane operators; who are regularly in the gas fuelling area or may be affected by any spills or releases from that area
- Local and national authorities, for example custom officials, who work a significant portion of time within the gas fuelling area

**Individuals that may come into contact with LNG during bunkering**

- Port staff who occasionally enter the gas fuelling area, including ship’s agent
- Visitors, including haulage company staff and contractors, who deliver to and collect cargoes from the port area but only spend short periods of time in the affected area
- Emergency services personnel who need to plan responses to potential hazard scenarios
- Local and national authorities who occasionally visit the facility for regulatory compliance purposes
- Passengers?
How much training should we have?

- LNG is not the cargo, it is not the reason the ship exists – it is just the fuel!

- Training needs to be limited and appropriate to role
  - Individual involved with LNG/gas full time/regularly (perhaps daily to once/week)
  - Individual involved with LNG/gas infrequently (more than once/month)
  - Individual involved with LNG/gas once or occasionally

**LNG industry training**

- LNG terminal staff
  - 3 – 4 months classroom training plus field experience
- LNG Carriers (all operations)
  - 1 - 2 weeks + 3 months experience on board
- LNG Road truck drivers
  - Typically a few hours
  - 1-2 days in UK/France
- LNG fuelled vehicle drivers
  - 1 – 2 hours

**SGMF framework**

Bunkering only – not full IGF syllabus
Multi-layer training

- Different training for different skills and different performance

**Assist**
- Individuals assisting with the transfer of LNG or operation of engines, generators and storage tanks

**Do**
- Individuals in charge of transferring LNG (supplier and receiver) and operator of the engines, generators and storage tank

**Manage**
- Individuals responsible for the management of the safety, environmental compliance, the vessel and the bunkering facility

**Respond**
- Individuals required to authorise or support the operation of the vessel, transfer of LNG or who have specific roles to play during emergency incidents
MANAGE role

- This training is aimed at individuals who are legally responsible for the transfer of LNG/gas but do not necessarily take part in the practicalities of the transfer

- The individual must be able to
  - understand the regulations at the LNG transfer location
  - ensure that the transfer process takes place within these restrictions.
  - be able to interpret regulations
  - ensure the operating manual is appropriate
  - risk assessing any changes and the impact of other simultaneous operations
  - ensure the Doer and their Assistant are competent and understand any special procedures for a transfer,
  - ensuring that all parties agree when and how the LNG transfer takes place
  - ensure that all equipment under their control is designed, operated and maintained to suitable standards.
DO role

- This training is aimed at individuals who perform the transfer of LNG/gas

- The individual must be able to understand
  - Understand and be able to follow the operating manual
  - Be able to perform a risk assessment for each bunkering
  - Understand the roles of others in bunkering and communicate effectively
  - Be able to ensure the safety of the LNG transfer process
  - Understand the LNG tank design and its limitations
  - Avoid venting gas
  - Perform and record measurements
  - Confirm transfer system is fit for purpose - compatible and undamaged
  - Connect the transfer system correctly - no leaks
  - Ensure ESD system connected and works correctly
  - Initiate and stop LNG transfer
  - Effectively supervise ASSIST role
ASSIST role

• This training is aimed at individuals who are involved with the transfer of LNG/gas but only under supervision of a better trained, more competent or more experienced individual.

• The individual must be able to understand
  • their own role
  • the behaviour of LNG/boil off gas (BOG)
  • how to connect and disconnect the transfer system to the manifold
  • need for and how to wear Personal Protective Equipment (PPE)
  • the requirement for effective and timely communication
RESPOND role

- Training aimed at individuals who occasionally come into contact with LNG or gas

- The individual must be able to understand
  - what LNG is
  - the hazards of LNG
  - evacuation procedures
  - basic LNG safety measures
  - how and when to contact the emergency services
  - how to initiate an Emergency Shut Down (ESD)
  - importance of reporting any incidents or near misses that they witness
SPECIALIST roles

• This training is aimed at individuals who will provide specialist services to enable a bunker facility to operate safely and in an environmentally responsible manner in a particular location.
  • Medical staff ranging from emergency doctors in local or regional hospitals to local first aiders needing familiarity with the causes and treatments of injuries caused by cryogenic material
  • Land based fire fighters, salvors, lifeboat crews and tug captains required to assist with the management of any spills and/or fires involving LNG (fire training for mariners is covered by the HTW Code)
  • Maintenance (and operating) staff working on specialist equipment needing knowledge from the equipment manufacturer.
  • Jetty staff (including line handlers) who may be called on to assist during ship movements
  • Staff in ferry terminals or on board passenger vessels responsible for mustering and mass evacuation
Modular training concept

- Aim is to create a comprehensive training package that individuals can progress through at different times during their career

- Operations distinct from management
- Onshore training is based on functional requirements so adapts well
- Mariner command/rank structure doesn’t always appear to follow functional requirements
- Mapping job roles is challenging!
  - SGMF hasn’t got there yet
Bunkering process

Ship uses bunker facility for first time

Compatibility study

Ship arrives at bunker facility

Moor alongside bunker facility
Agree amount to be transferred
Complete bunker checklists and countersign

Install drip trays/commission water sprays
Connect bunker hose/hard arm
Test ESD and communication system

On arrival checks

Bunkering system connection

Transfer LNG at full agreed flowrate
Handle any BOG generated
Transfer agreed quantity of LNG

Remove any air from bunker system

Cool down using small flow of LNG
Continuous leak checking

Custody transfer

Purging

Cooling Down

LNG Transfer

Purging & Disconnection

Drain any LNG
Remove any hydrocarbons from bunker system

Complete contractual paperwork

Ship leaves bunker facility

Ship leaves bunker facility for first time
SGMF Bunkering Competences Overview

Operating & Regulatory Framework
- Regulatory Environment
- Organisation and Management
- Bunkering Safety & Operating Manuals

Ensuring a safe environment
- Risk Assess for safety
- Communication
- Understanding of the roles and responsibilities of the various parties involved
- Understanding own role and responsibilities during bunkering
- Prepare vessel/port area for LNG transfer

Checking Equipment as “Fit For Purpose”
- Examine transfer system for damage & wear
- Electrical isolation
- Mechanical Handling & Support Devices
- Safety Equipment
- Personal protection
- Duty of Care on own equipment

Connection & Function Testing of the LNG Transfer System
- Connection of the LNG Transfer System
- Purging
- Leak Testing

Transferring LNG
- Cooling Down
- LNG Transfer
- Advanced Control, Monitoring & ESD Systems
- Basic Control, Monitoring & ESD Systems
- Managing Tank pressure
- Draining, disconnection & Storing Equipment

Drain, Disconnect & Store

Responding to Emergencies
- Responding to Emergencies
- Making Safe (advanced)
- Making Safe (basic)

Responding to Emergencies
- Managing Emergencies

Quantity & Quality
- Q&Q Measurement
- Q&Q Meaurement

Familiarisation
- Port, Ship and equipment specific training (excluded)
Example: LNG transfer

- Ensuring the safe transfer of LNG, including the control and monitoring of the transfer and dealing with abnormal events;
- Management oversight or governance of the process
Example Module

Advanced Control, Monitoring & ESD Systems

- Categories Applicable to:
  - DO, MANAGE
- Module summary
  - Understand how the LNG transfer process is monitored and controlled including the purpose and content of the various control systems and the handling of alarms
  - Understand the function of the Emergency Shut Down (ESD) system and how it is connected, tested and activated. Understand how to reset the ESD and recover from common events
- Competence required
  - Demonstrate how to respond to alarms caused by a variety of abnormal events and understand their likely causes
  - Understand the functions of the fire and gas monitoring system and the implications of and management of an alarm
  - Understand why and how to link/connect an ESD system from LNG supplier to LNG receiver
  - Understand the philosophy of how ESD systems work and the different means and levels of activation including the impact of actuating the ESD system
  - Understand the procedure to follow in the event of an ESD occurring to find and correct the underlying cause prior to restarting
  - Understand the additional procedures and checks required should a linked ESD system not be available
- Underpinning knowledge
  - Monitoring Devices (section 6.5.2)
  - Fire detection systems (section 6.5.3)
  - Gas detection systems (section 6.5.1)
  - Emergency Shutdown System (section 6.5.4)
Example: Underpinning knowledge

Monitoring Devices

- Temperature measurement
  - Types
  - Limitations
  - Alarm set points
- Pressure measurement
  - Types
  - Limitations
  - Alarm set points and actions
- Level measurement
  - Float
  - Radar
  - Capacitance
  - Principles of operation for each type
  - Operating requirements for each type
  - Limitations
  - Maintenance requirements
  - Alarm set points and actions
Familiarisation

- Many processes will need to be specific to the ship, port or individual equipment selections
- The competence requirements and subsequent training cannot be quantified so is excluded from the SGMF training guidelines
- A “generic” module is included as a reminder
Stage 2 – Training & assessment

• Is setting the training agenda sufficient?

• Should SGMF also suggest how skills should be assessed?
  • eg Some form of practical demonstration is required for ….

• Key issues
  • Balance between theoretical knowledge and practical skills
  • How experience should be valued
Training & Assessment Methods

• Individuals have their own preferred style of learning
  • Theoretical learning
    o Classroom style learning
    o Distance learning (books, course material)
    o Computer based training (DVDs, multimedia)
  • “Hands on” learning
    o Practical demonstrations and exercises
    o Use of Simulators
  • “On the job” instruction

• Multiple methods may be needed to gain qualifications

• Value of practical training in building experience
  • Understanding “what ifs”
  • Cost of training
  • Difficulty of assessment

• Can simulation replace practical training?
  • “Computer Gaming” technology
Assessing success

• What is required?
  • Awareness of the technology?
  • Understanding of the issues and the background knowledge?
  • Demonstration of effective skills?

• Are we training and CERTIFYING
  • I understand what to do
  • I have done it once unsupervised

• Or ensuring competence and QUALIFYING
  • I underwent the training and became certified
  • I built up the necessary experience
  • I can do this on my own unsupervised
  • I have qualified
Stage 3: Accreditation?

• Should SGMF accredit course and training institutions?
  • Ensuring minimum standards and dissemination of best practice

• Should SGMF become an “Engineering Institution” for individuals
  • Qualification or experience based/examinable entry
  • Ensuring continued professional development
  • Progression through increased skills and/or experience
  • Crew qualifications become transportable
Summary

• Training and competence are essential in ensuring the safety of the growing LNG as fuel industry

• SGMF, through its members, is close to concluding the content of its competency framework

• The competency framework covers all who are involved in LNG bunkering, not just mariners

• SGMF is starting to grapple with assessment requirements

• A clear view has not been arrived at

• Ensuring implementation of consistent best practice is the final element that SGMF needs to work towards
Abbreviations

- BOG – Boil off gas
- ECA – Emission Control Area
- ESD – Emergency Shut Down
- EU – European Union
- HSE – UK Health & Safety Executive
- HTW – IMO Sub-Committee on Human Element, Training and Watchkeeping
- IGC – International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk
- IGF – International Code of Safety for Ships using Gases or other Low-flashpoint Fuels
- IMO – International Maritime Organisation
- PPE – Personal protective equipment
- Q&Q – Quantity & Quality
- SIGTTO – Society of International Gas Tanker & Terminal Operators
- SGMF – Society for Gas as a Marine Fuel
- T&C – Training and competence
we sea change, do you?