2ND MEETING OF THE EXAM COMMISSIONS FOR PROFESSIONAL QUALIFICATIONS

Examination of LNG expert on inland vessels & perspective for other new fuels

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Adri van der Hoeven

Expert inland navigation

CBR, CCV (examination board in the Netherlands)

topics presentation LNG

Normally a presentation consists of oral and written knowledge transfer.
My assignment was to process all information in the presentation.
The aim is to start an interactive conversation afterwards.

- Intro
- What is LNG?
- Physical characteristics
- What is going on on board an LNG-powered inland vessel?
- Critical actions on LNG-powered inland vessels
- Examination LNG expert according to RPN
- Examination LNG expert according to ES-QIN
- What is not to be tested on board an LNG vessel in operation
- Situation in the Netherlands (and Germany)
- Practical solutions
- New fuels
- **Due to time and the presentation assignment, I will not go into environmental matters.**

Intro

- **Seagoing ships powered by LNG**

  → Hundreds of vessels; Why? The environment demands it, governments often facilitate and prohibit (sulphur-containing) them.

  → Some LNG-carriers uses their own cargo as fuel.

- **Inland navigation powered by LNG**

  → Now about 40 vessels

  → The demand for greening is slowly getting underway.

  → The cost and thus the payback period.

- **Future**

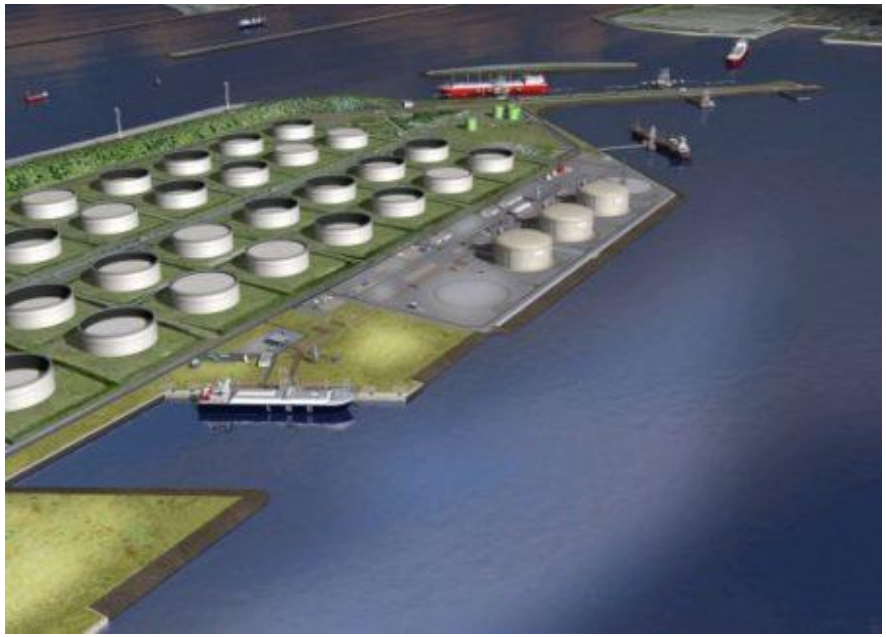
  → There are currently construction orders for approximately 60 inland vessels.

  → One animator is an oil major

  → Fuel cell, new fuels

What is LNG?

- **LIQUEFIED NATURAL GAS**
  - → Liquid by pressure CNG (>200 bar)
  - → Liquid by cooling (-162ºC)
    - → How?
      - → Cooling
      - → Or most of the time gassing
  - → Expansion
    - → From gas to liquid 600 ltrs gas = 1 ltr liquid
    - → 1ltr liquid = 600 ltrs natural gas (NG)



Yukonhaven

Physical characteristics LNG

→ Basic is 80-90% Methane (CH_4); Natural gas (NG) must be 'cleaned' before condensing; (water at -162ºC becomes.....)

→ flashpoint -187º therefore category 'extremely flammable'.

→ NG becomes at -162ºC (max: auto-refrigeration process) LNG and shrinks factor 600!

→ Odourless (mercaptan / methanethiol)

→ Melting/freezing point -182℃

→ Flashpoint -187℃

→ Upper explosion limit 15%

→ Lower explosion limit 5%

→ Relative vapor density 0,614 (air =1, at 20 ℃ and 1 atmosphere), so…

→ Density by 15ºC 450 kg/m3

→ Auto-ignition temperature 537 ℃

→ UN number 1972, ADN Hazard class 2

What is going on aboard an LNG powered inland vessel?

Mts Argonon 2011

- → No cooling installation
- → Always checking temperature, pressure
- → How to cool?
  - → Take (or let) NG out of the tank (to use or just blow of)
  - → LNG evaporates and takes place in the room where the NG was
  - → Heat is needed for evaporation, so the temperature is going down
  - → Circulation by spray line
- → Maximum pressure cryogen tank (blow of) for use on inland vessels: 8 bar
- → operating pressure >1-3 bar
- → To keep the LNG tank stable, there must be a reasonably constant decrease.
- → Visit yard for maintenance. Empty and inertize LNG tank.
- → Prepare LNG tank for bunkering after yard visit.

Critical actions on LNG powered inland vessels

- **Blow off**

  → Due to little decrease due to shipping blockage, shutdown due to malfunctions, etc.

- **Brittling**

  → In case of LNG spillage on deck, the high thermal stresses generated can result in the fracture of the steel (brittling).

  → Stainless steel is impervious to embrittlement.

- **RPT (Rapid Phase Transition)**

  → When LNG is released by a spill, it heats up quickly and expands by a factor of 600. Looks (without fire) like and the damage is like an explosion.

- **Burns**

Examination LNG expert according to current RPN

→ The practical part of mainly includes knowledge standards. Something about the attitude when working with LNG is asked. Only the latter includes firefighting, without stating whether this is a knowledge or skill element.

→ Because it mainly concerns knowledge elements, this can be questioned during the practical exam.

→ The exam takes place at a practical location. If an LNG bunkering matches the end of a course, the exam will take place at the bunker location. The course involves continuing 12+ students.

→ Due to economic (cost MCV or MTV: € 3,500 - 5,000/day) and safety aspects, not every candidate can perform the primary actions. Especially monitoring and controlling the bunkering process. Control in temperature, pressure, gas and liquid phase can only be performed a few times during bunkering.

→ Under RPN, practical examination is passible by asking the knowledge.

Examination LNG expert according to ES-QIN

→ The standard is constructed using the well-known category I and II principle.

→ 9 of the 11 category I elements must be tested per exam. The score must be at least 7/10.

→ For the category II elements, 5 elements of 7 must be tested. The average score should be 6/10. A failing grade may therefore be compensated by a score of another category II element.

→ Part II describes the technical requirements of the exam location.

→ An overview of impossibilities in terms of location design:

- → a LNG bunkering system including a bunkering station,
- → a LNG containment system,
- → a LNG piping system,
- → a gas supply system,
- → a gas preparation system.

Elements that cannot be tested on board inland vessel in operation, during practical exam ES-QIN (1)

In summary text

→ 3.1 monitor the complete LNG installation to prevent boil off (I)

→ 4.1 perform daily, weekly and regular periodic maintenance (I)

→ 4.1 correct malfunctions detected during maintenance (I)

→ 5.1 start, monitor and ending bunkering procedures complete (I)

→ 5.1 perform safe bunkering (monitor pressure, temperature and LNG level in tank, etc.) (I)

→ 5.1 safe ending bunkering (purging, valves and disconnect craft bunkering installation. Communication) (I)

→ 6.1 vary LNG tank temperature (maintenance, ship yard)

→ Inerting, drainage LNG, first filling (drying/cooldown)

Elements that cannot be tested on board inland vessel in operation, during practical exam ES-QIN (2)

In summary text

→ 7.1 reacting to LNG-spills, skin contact, spills in close spaces, spills inter-barrier (pipes, tank). (I)

→ 7.1 reacting appropriately in case of fire in the vicinity of LNG or NG. (I)

→ 7.1 react appropriately in case of pressure built up in/by pipe systems after emergency shut down / activation imminent boil off (I)

→ 7.1 emergency handling by fire (control LNG fire, pool, jet and flash fire) (I)

Situation in the Netherlands (and Germany)

- **Training and examination**

  → There are 3 training institutes that train LNG experts on inland vessels:

    → one focuses exclusively on crews of a ferry service on the near coastal maritime waterways (Wadden Zee)

    → two focus on crews of inland vessels

  → Two of those training institutes use a simulator:

    → Part of an LNG powered 1000 TEU shortsea ship. For inland navigation, they can remove de vapor return hose

    → a simulator of a system for LNG powered inland vessel.

  → all trainers train coupling and uncoupling in a practical set-up or on a ship

- **Bunker places**

  → Installations: Köln (D) and Maasvlakte (NL)

  → By trailer: several designated places (D + NL)

Practical solutions

→ The trainers in the Netherlands have various simulators that can simulate the required actions for loading and/or unloading LNG.

→ For bunkering LNG, there is a simulation for a seagoing ship and one for an inland vessel.

→ An investigation has shown that all process actions can be simulated. Especially the parts mentioned earlier that are difficult to examine in practice.

→ Naturally, the NL Examination Board has regular consultations with suppliers of simulators.

→ One of these simulator suppliers is currently designing a simulator that can mimic working with inland LNG fuel systems. They also want to set up the simulator modularly so that systems with a fuel cell can also be simulated.

→ In addition, a practical set-up would then be required to practice and test the connection and disconnection of LNG.

→ See also communication from the Dutch delegation, CESNI/QP (21) 53 from June 2021.

New fuels

- **Vessels are currently being designed with other propulsions:**

  → fuel cells generate power from:

    → Hydrogen,

    → Ammoniac and

    → Methanol

  → The fuel is brought on board in interchangeable containers/tanks

  → Beware! These fuels require 2 blue cones during transport due to toxicity.

  → **In view of the fuels for these fuel cells, qualified personnel will also need to be on board.**

  → electric with exchangeable battery units, charging ashore.

Interaction and questions

Thank you for your attention!

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