

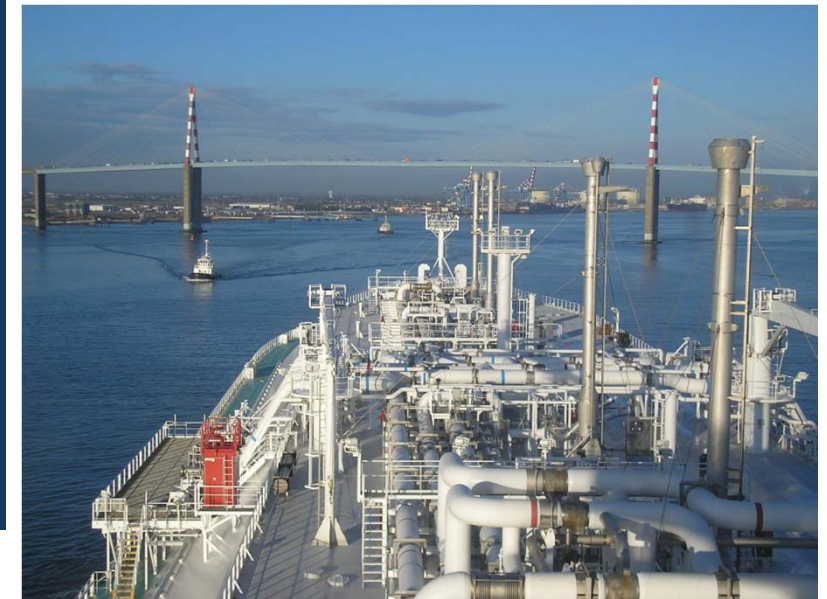


## LNG Shipping & the terminal interface

- how SIGTTO manages risk

Cyprus

27<sup>th</sup> October 2017



# CONTENTS

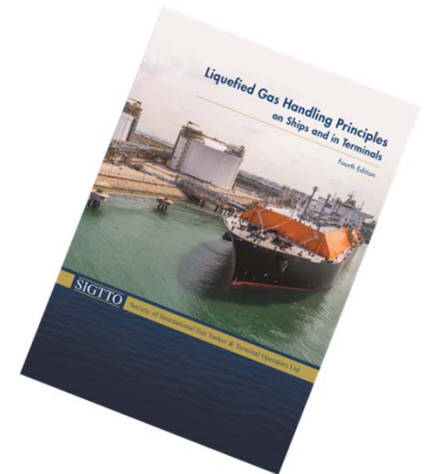
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- LNG Shipping History
- SIGTTO
- LNG Shipping Safety
- Regulations and best practice
- Risk management
- Summary

# SIGTTO

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- A “not-for-profit” organisation
- Only remit is safety – no commercial role
- Registered in Bermuda with London liaison office
- 200+ Members from across the LNG/LPG industry
- About 97% of LNG tonnage and terminals are members
- Publishes guidelines, recommendations and best practice
- Issues technical advice
- NGO status at IMO
- Panel Meetings & Regional Forums
- Liaises with other industry bodies



# Our membership – Liquefied gas ships and terminals

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# Publications

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- Five paid publications in two and a half years
- Two more due this year and two more next year
- Revised IGC code and IGF code published
- (update) LPG Ship/shore interface (end 2017)
- (update) Manifold guidelines revision - Joint with OCIMF (end 2017)
- (new) Gas Detection (2018)
- (update) Alleviation of Surge on ESD (2018)



# Liquefied Gas Shipping History

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LPG Tanker Agnita 1931



Methane Pioneer 1959



Methane Princess 1964

# LNG Shipping Safety Record

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- Over 50 years of commercial operation (Oct 64)
- Over 90000 cargoes (88229 end of 2016/4382-2016)
- Over 500 ships in service
- No loss of cargo tank containment
- No onboard fatalities directly attributable to the cargo



An very impressive, in fact, unprecedented, safety record for the carriage of liquid hydrocarbons at sea in bulk.

We owe a great credit to those who drew up the IGC code many years ago in the infancy of LNG shipping

# How was this safety record achieved?

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- Strong, overarching safety philosophy
- Robust design of equipment and systems
- Good operational & maintenance procedures
- High standards of training coupled with competency verification
- An ability to share lessons learnt and to develop best practices as an industry (SIGTTO)
- IGC Code (International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk) was developed based on actual experiences in the early days of LNG transport

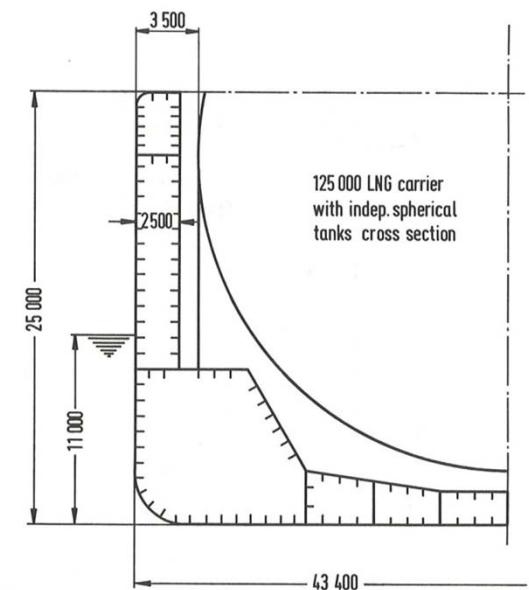




# Safe Distances and Safe Separation

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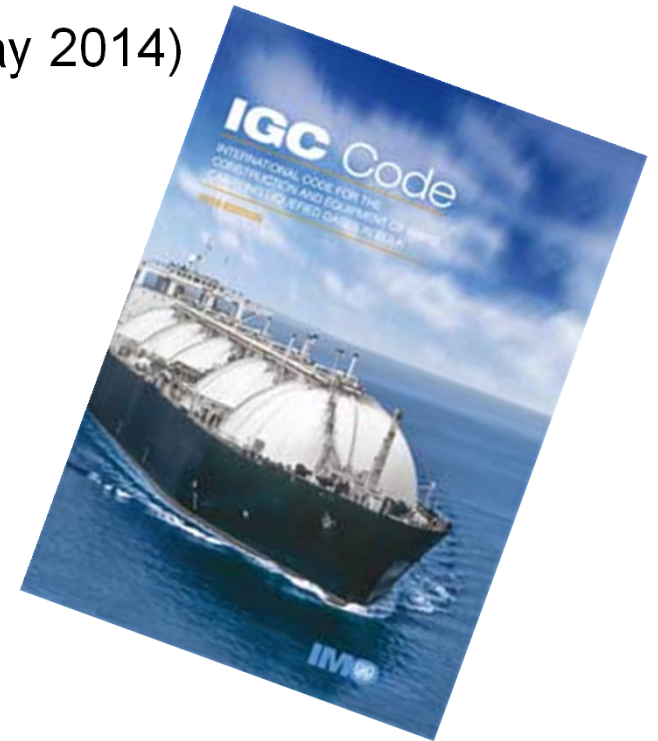
- Gas Code requires LNG vessels to be double hulled with a minimum specified distance between the outer part of the cargo tank and the ship's side
- In practice there are normally at least 3 barriers between the outer hull and the cargo tank
- All credit to those who drew up the IGC code many years ago in the infancy of LNG shipping



# Revised 2016 IGC Code

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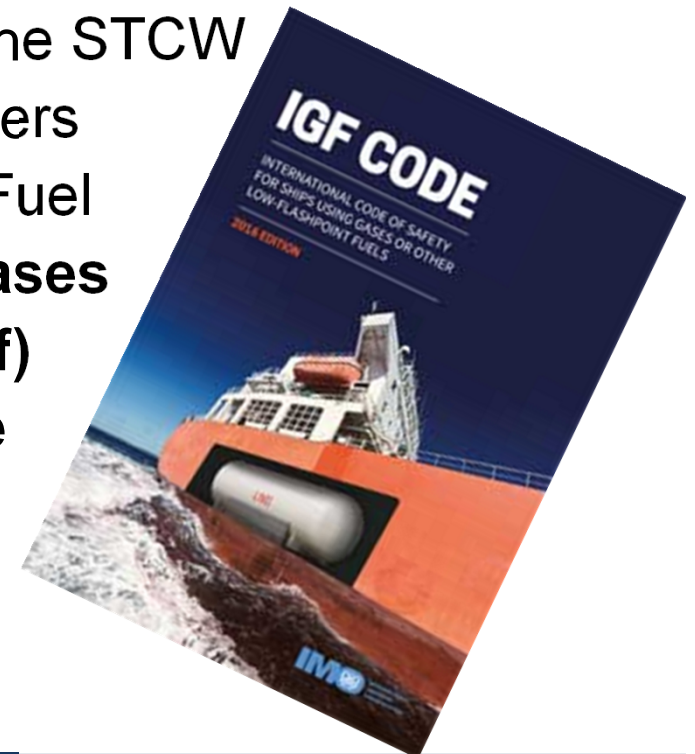
- The Revised Code was Adopted at MSC 93 (May 2014)
- Entered into Force **1 January 2016**
- Application/Implementation date is **1 July 2016**  
due to existing ship building contracts
- Not retroactively applied – only applies to  
vessels contracted/keel laid after 1 July 2016
- SIGTTO played a key role in facilitating  
the revision – started 2007



## The IGF Code (Gas fuelled ships)

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- IGF Code adopted at MSC 95, June 2015.
- Entered into force on **1 Jan 2017**
- MSC 95 also adopted amendments to the STCW Interim Guidance on Training for seafarers sailing onboard vessels using LNG as Fuel
- **Note: Gas carriers using liquefied gases as fuel (not necessarily cargo Boil-off) and complying with the IGC Code are exempt from the IGF Code**
- Phase 2 Corr Group dealing with methanol and low flash diesel



# Anti LNG Lobby – lifting guidance out of context



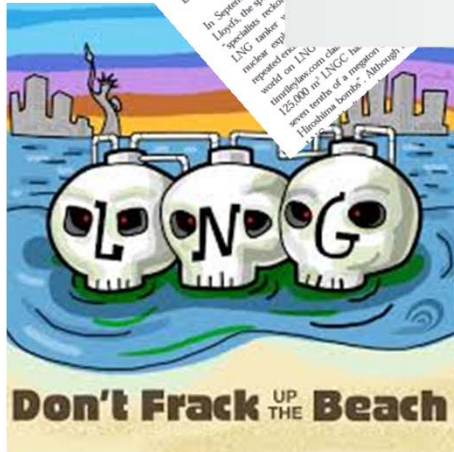
## Exploding the myth

**ENERGY** The anti-LNG lobby has compared LNG ships to nuclear bombs – is this simply emotional scaremongering or does it have any basis in fact? Roger Rowe of SIGTTO and Gordon Milne of Lloyd's Register debate

In September 2014, Lloyd's Register published a report on LNG. It stated that LNG is a 'clean' fuel and that the 'risk of a major LNG incident is very low'. However, the report also stated that LNG is a 'highly flammable and explosive gas' and that 'a major LNG incident could have catastrophic consequences'.

## Citizens Against LNG

Working for a renewable world

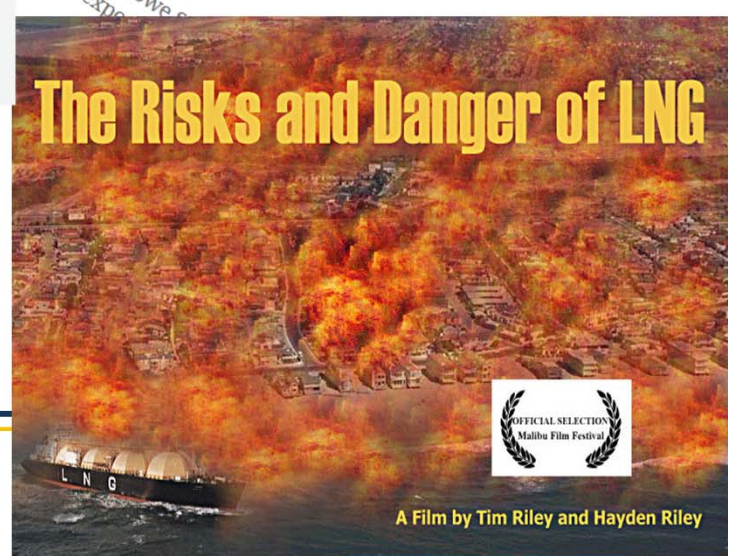


APR 27

## WOODFIBRE LNG – WRONG LOCATION:

By Jef Keighley

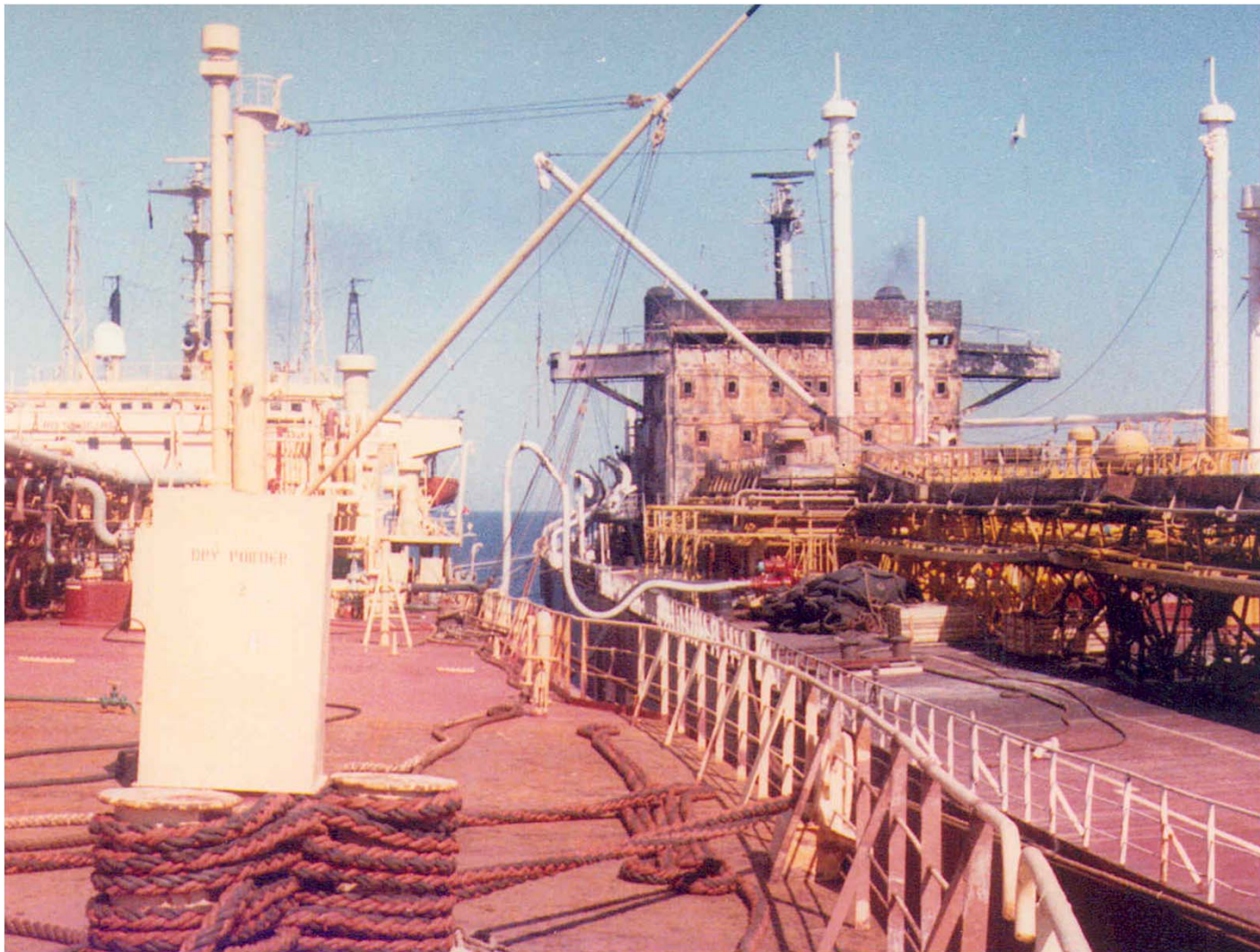
Woodfibre LNG fails all of SIGTTO's internationally accepted industry standards for the safe siting of LNG terminals





# Gaz Fountain - 1984

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# LNG Grounding

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# M/T LIMBURG

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- Crude Tanker - bomb in small boat
- Holed at waterline
- Cargo ignited
- Did not explode
- Internal tank structure by hole undamaged



# USS Cole



- US warship also hit by bomb in small boat
- 17 sailors in the compartment by the bomb killed
- Internal bulkhead undamaged



# Sandia Report

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## SANDIA REPORT

SAND2011-9415  
Unlimited Release  
Printed December 2011

### Recommendations on the Prediction of Thermal Hazard Distances from Large Liquefied Natural Gas Pool Fires on Water for Solid Flame Models

Anay Luketa

Prepared by  
Sandia National Laboratories  
Albuquerque, New Mexico 87185 and Livermore, California 94550

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000

Approved for public release; further dissemination unlimited.

# Sandia Report

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## Summary of conclusions:

- Risks from accidental spills are small and manageable
- Intentional events can be significantly reduced with security
- Expected sizes for intentional threats are nominally five square meters
- Most significant impacts to public safety within 500m of spill
- Large, unignited LNG vapour releases are unlikely
- Cascading events are not expected to greatly increase hazard ranges

# Public education

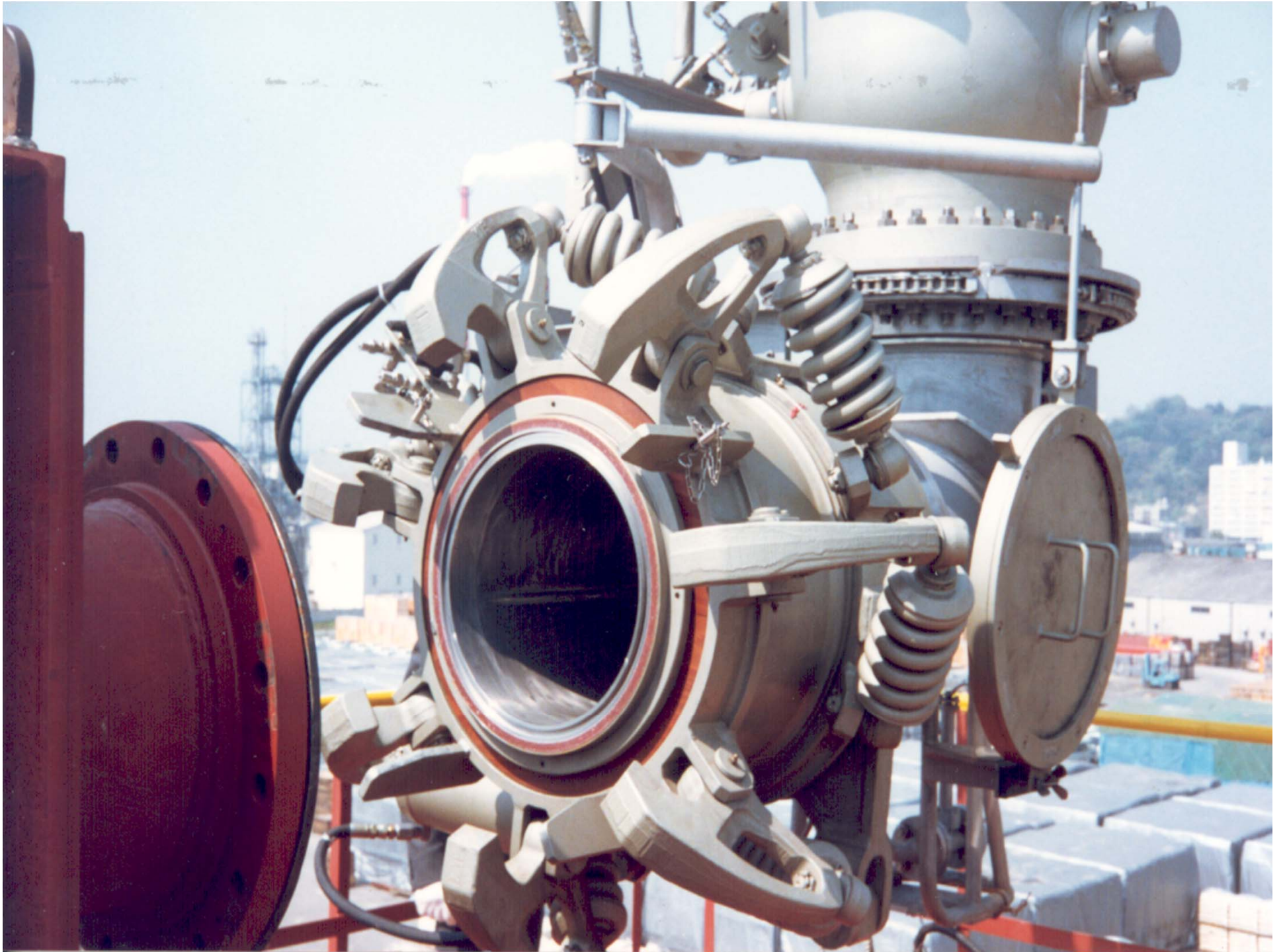
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- **Gas Carriers are not “Floating Bombs”**
- **Public perception is often that an attack on a gas carrier will result in a huge explosion that may harm people and property in the vicinity.**
- **Vessels are robust ships, soundly designed and constructed, well equipped with safety and emergency systems**
- **There is a necessity for Good Contingency Planning**
- **Catastrophic events caused by hydrocarbon gases in liquid phase are few**
- **Refrigerated Liquefied Gas Tanks are Highly Unlikely to Explode – but will burn until fuel is consumed**

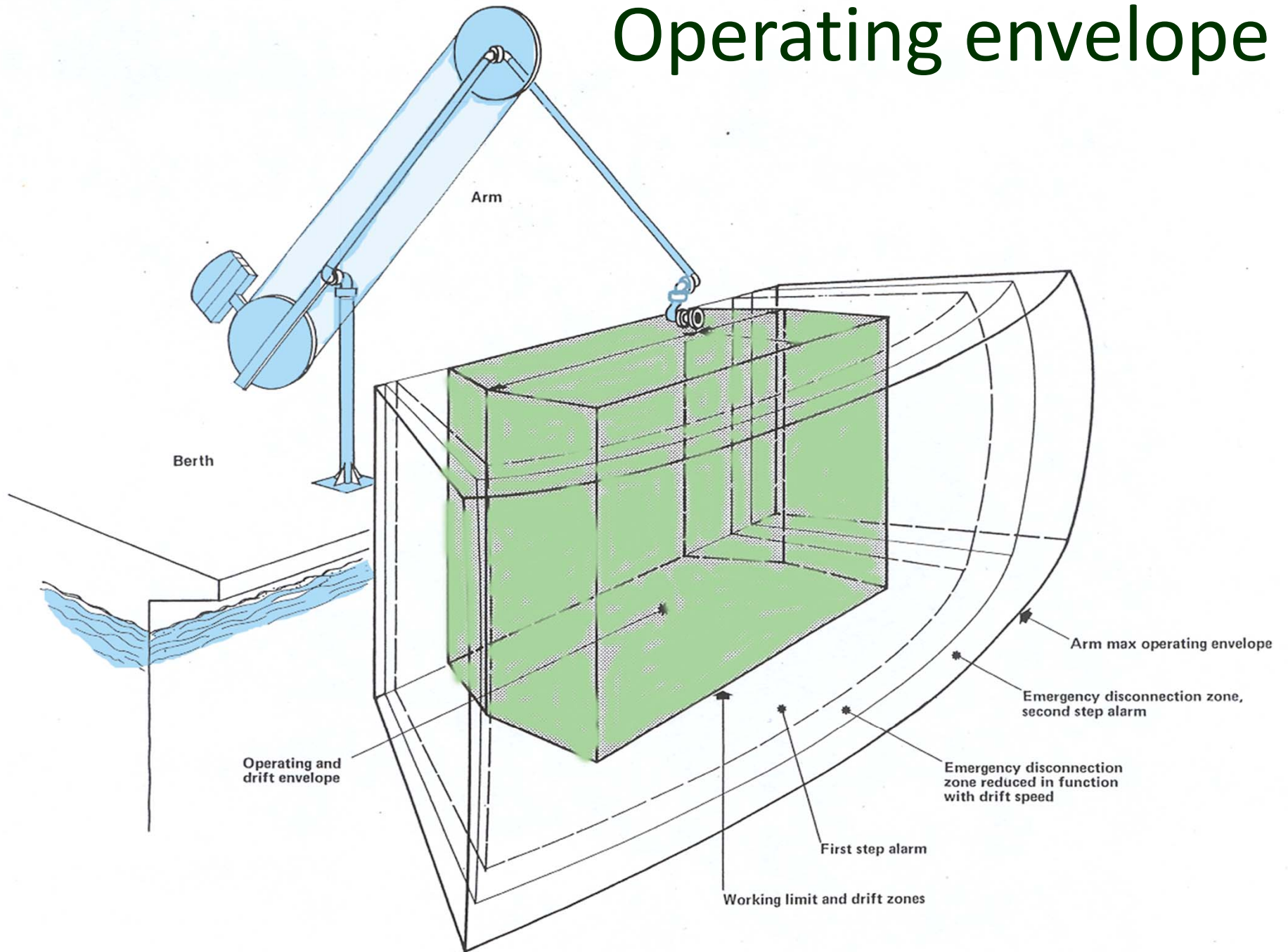








# Operating envelope







## ERS (PERC) Failures

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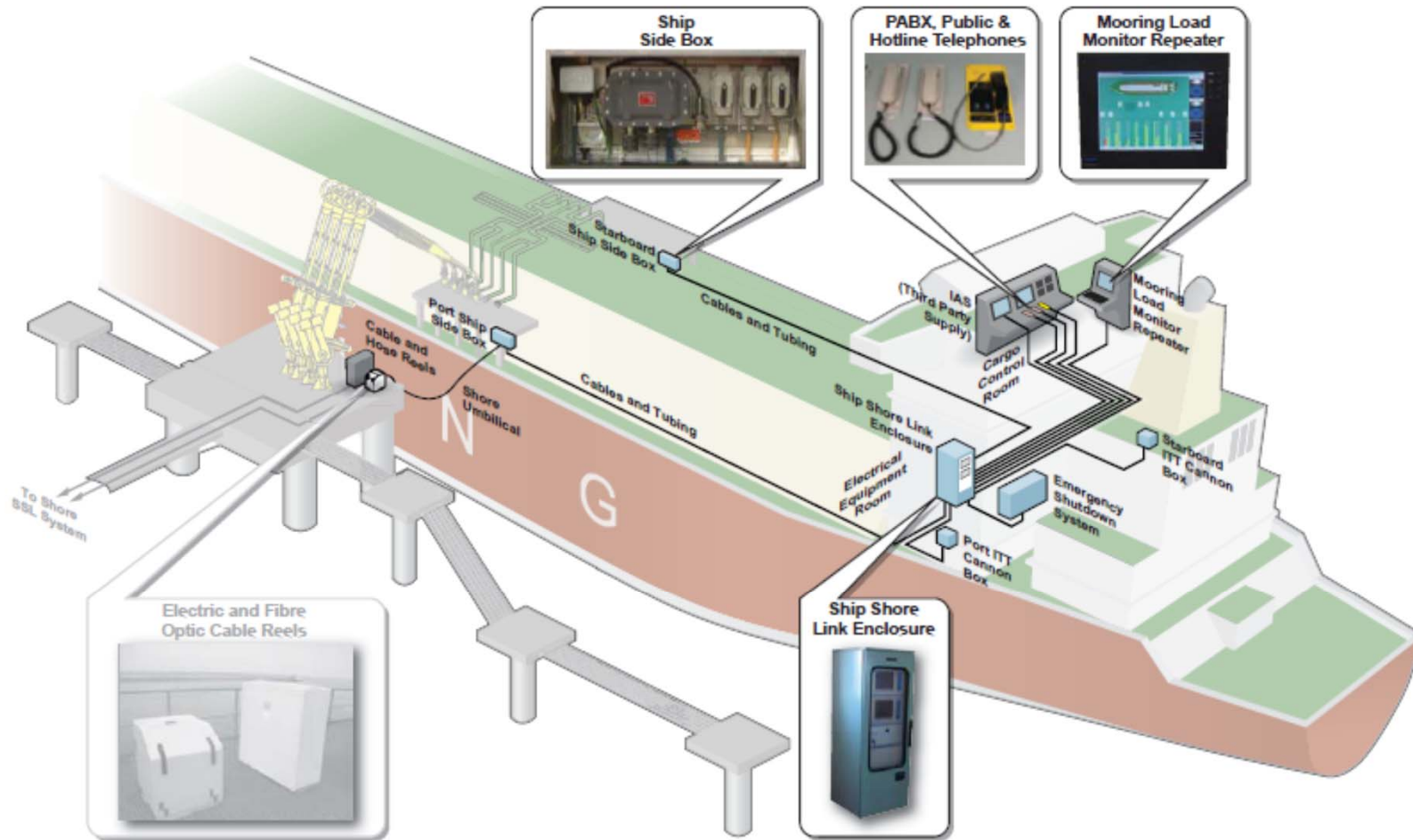
- Industry concerns about reported PERC uncontrolled releases
- WG examined all aspects of this issue and developed SIGTTO guidelines.
- All manufacturers were on the WG
- Not covering Design or LPG or STS
- Published January 2017





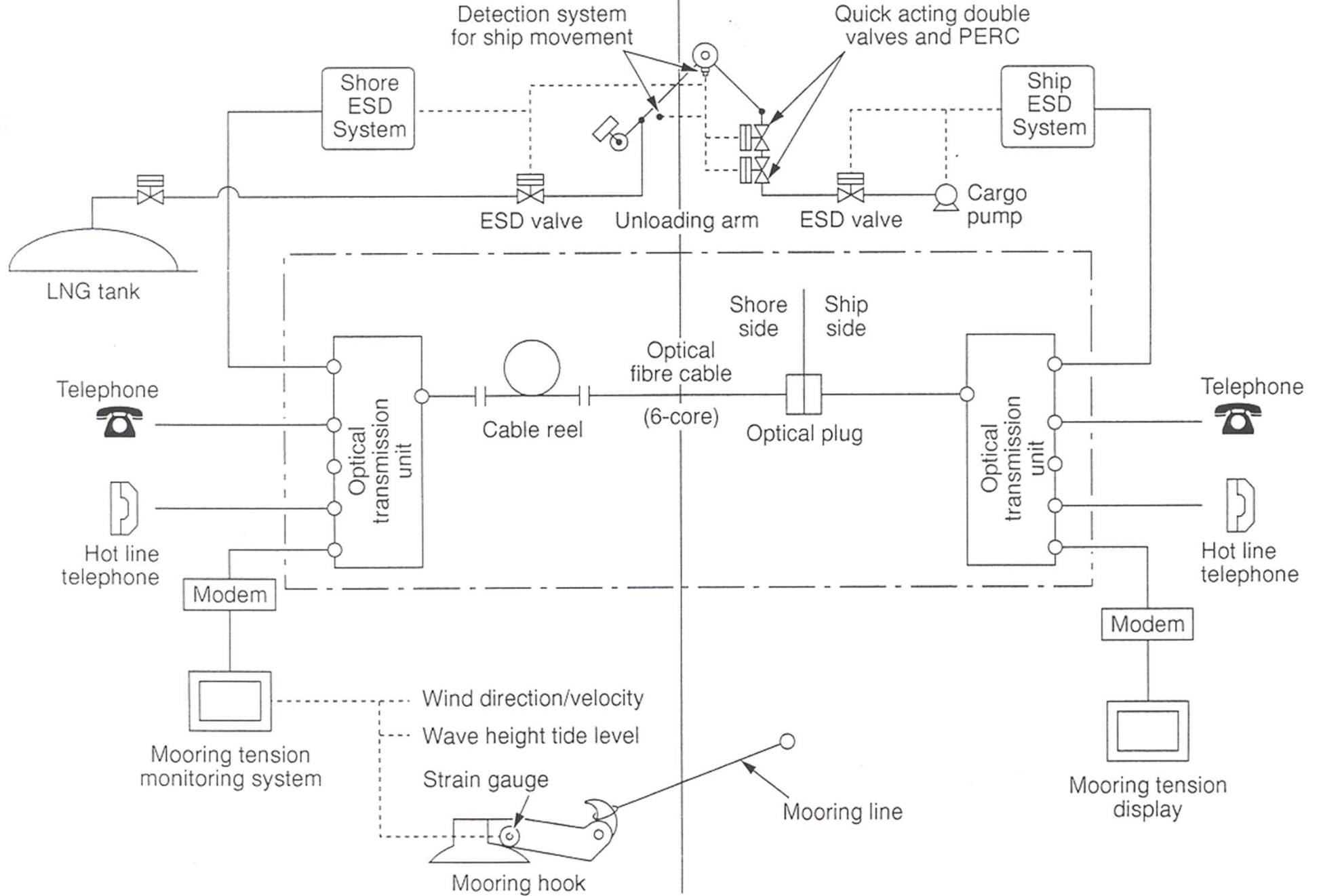


# Ship – Shore Link



**SHORE**

**SHIP**





# Industry incidents

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- In the last 18-24 months:
  - Three LNG collisions
  - Three LPG collisions
  - Two LNG groundings
  - One loss of containment through riser in port
  - Mooring line incident in Milford Haven
  - One LPG collision involving piercing of a type C tank
  - LNG vessel attacked in Red Sea
  - LNG vessel attacked off West Africa
- All of the above are members and have shared or will share lessons learnt at SIGTTO meetings.

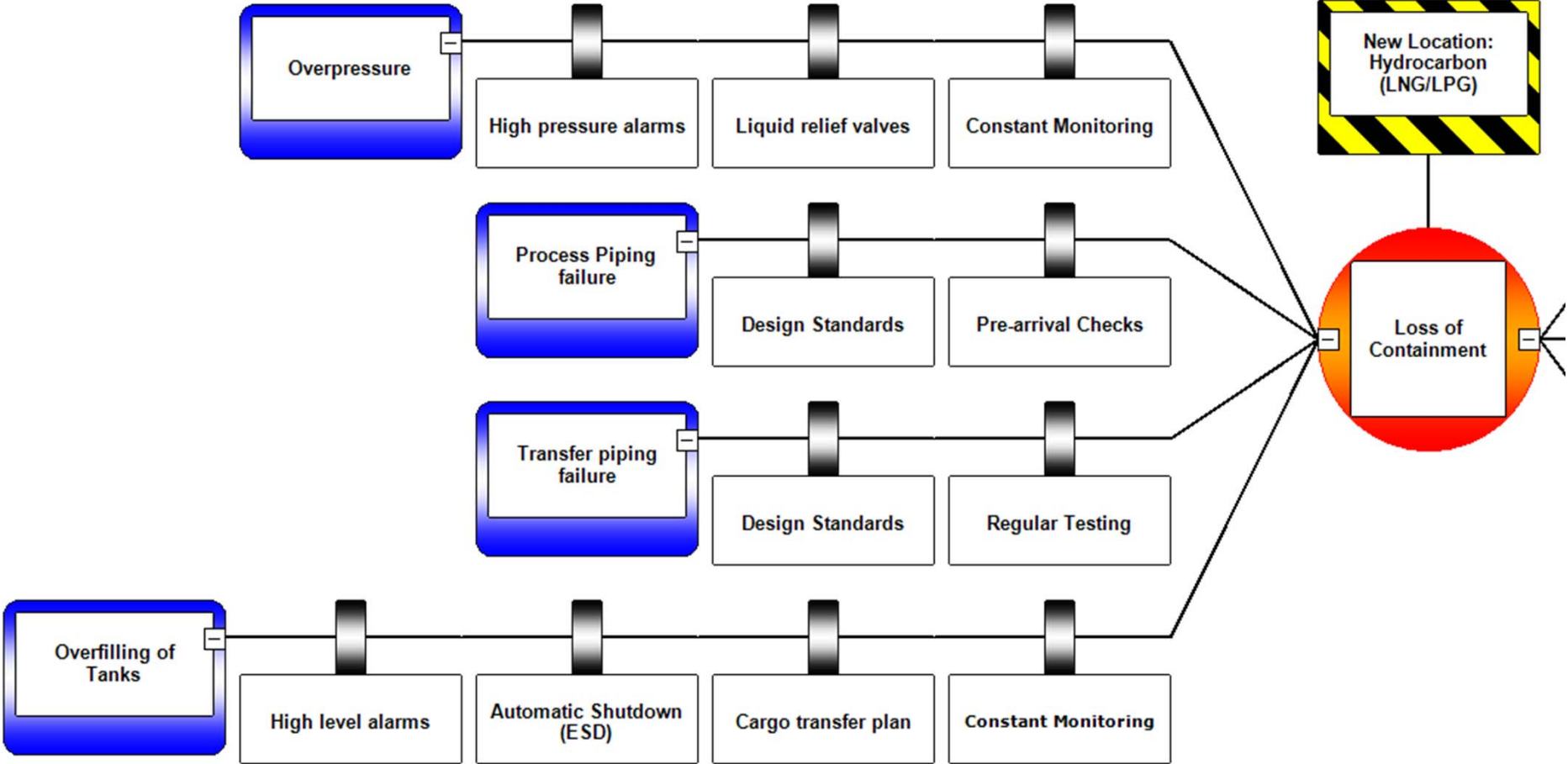


# Industry incidents - action

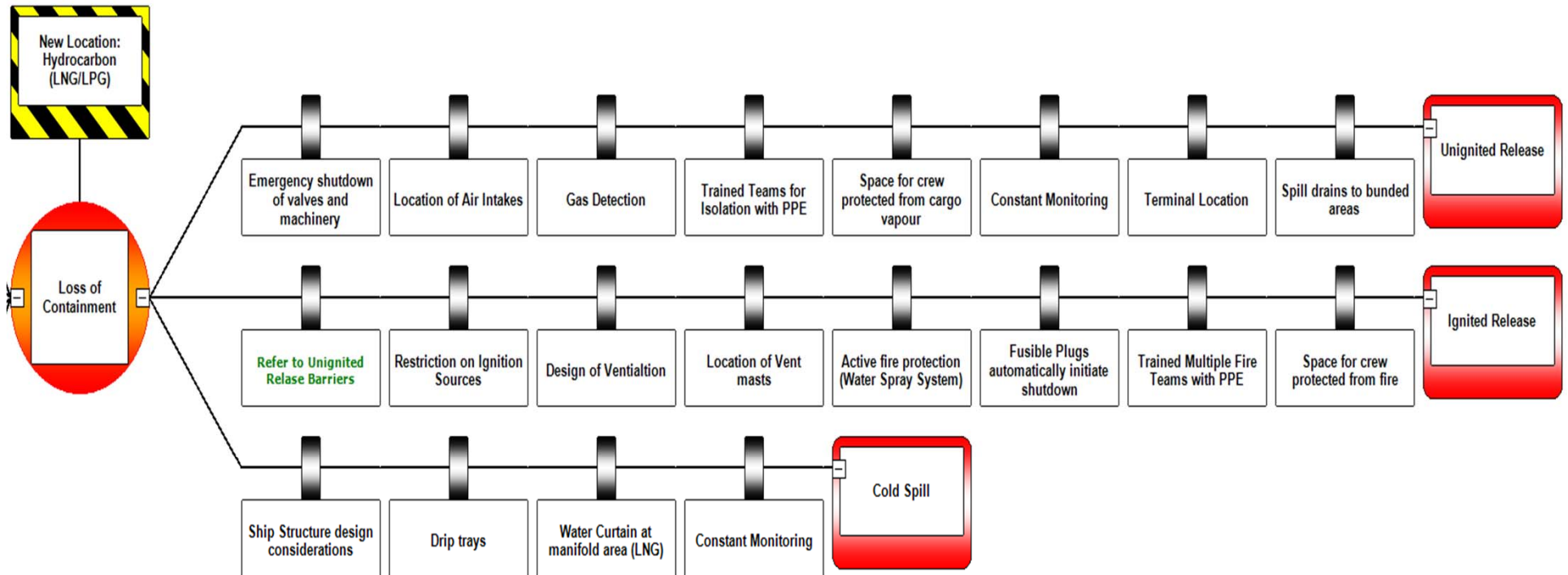
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- Secretariat is suggesting using a risk based philosophy
- Industry well equipped for addressing SIRE type observations
- Apparent focus on slips, falls, minor incidents etc
- A need to focus more on major accident prevention
- Use of major accident/process safety risk management tools like “Bow tie”
- Prioritise training on major incident risks and avoidance
- “Engineer out” the human factor in design where possible
- For example - Interlocks to prevent running of pumps when high level alarms disabled

# Generic Loss of Containment example

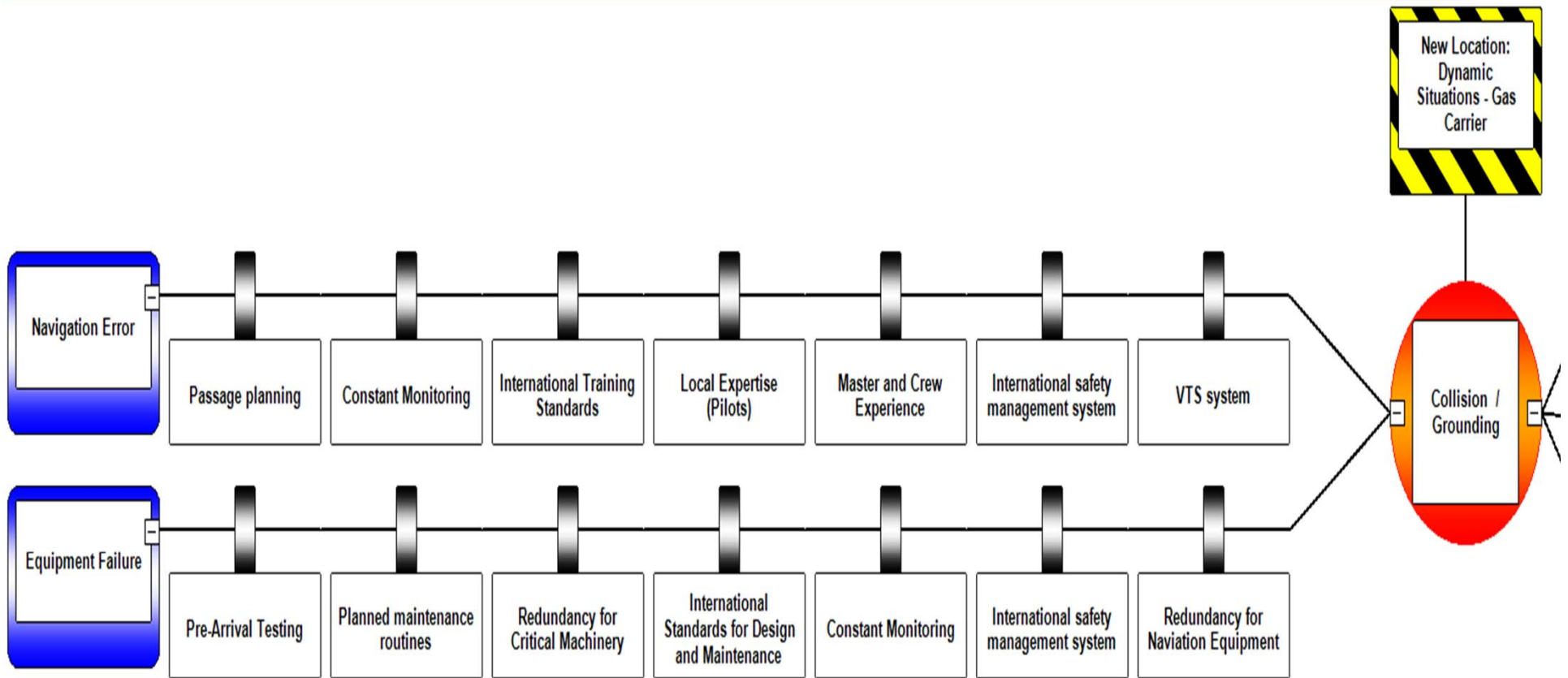


# Generic Loss of Containment example

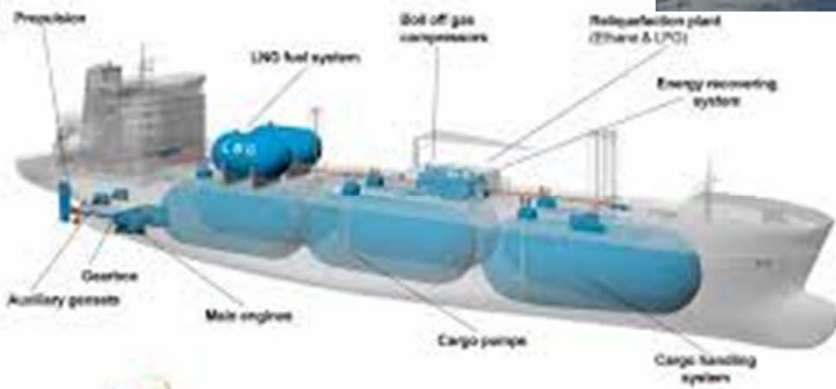




# Generic Collision /Grounding example



# Ethane



# Liquid Hydrogen Carriers (-252c flam range 4-74%)





# The world's first Compressed Natural Gas (CNG) Vessel

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Thank you!



**SIGTTO**

Continually promoting best practice in the liquefied gas shipping and terminal industries



**SIGTTO**