

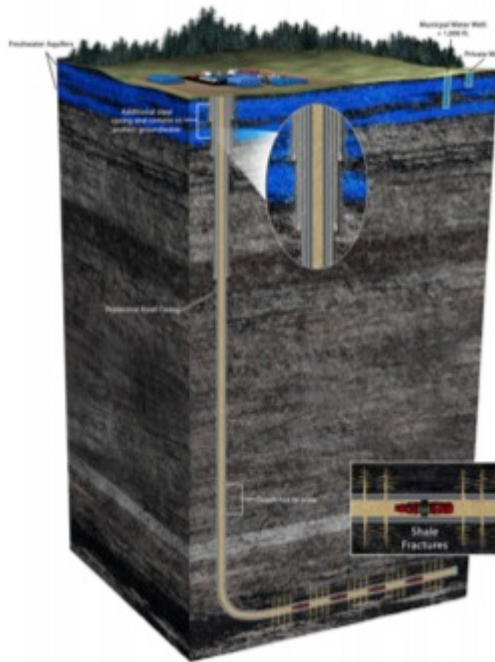


LNG as a Marine Fuel: Developments in North America

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Drivers

- A confluence of enablers
 - Environmental legislation
 - Regional requirements
 - Federal requirements for US flag vessels
 - North American and Caribbean ECA



- Shale gas availability
 - Low gas price expectation
- Environmental credentials

Vessel Orders & Interest

- Orders
 - Harvey Gulf PSVs
 - TOTE Orca Class Conversions
 - TOTE Containerships
- Approved designs
 - Waller Marine ATB Barges
- Areas of interest
 - Coastal Container Trades
 - Great Lakes
 - Ferry Projects



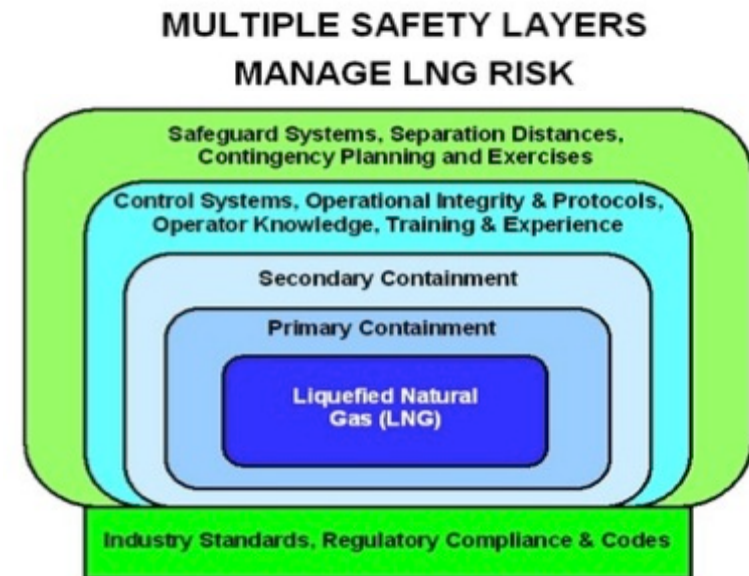
Infrastructure Development

- Expected Use
 - ECA compliance
 - Infrastructure supported
 - Dedicated routes
 - Known availability
- Infrastructure Plans
 - Liquefaction
 - Distribution
- North America moving rapidly



Safe Transition to Gas

- Build on LNG carrier experience and safety record
 - Safety philosophy
 - Understanding of fuel characteristics and handling
 - Operational and technical practices and standards
 - Information sharing
- Cognizance of existing bunkering practice
- Development of vessel standards
- Training considerations
 - Competencies
 - Practices



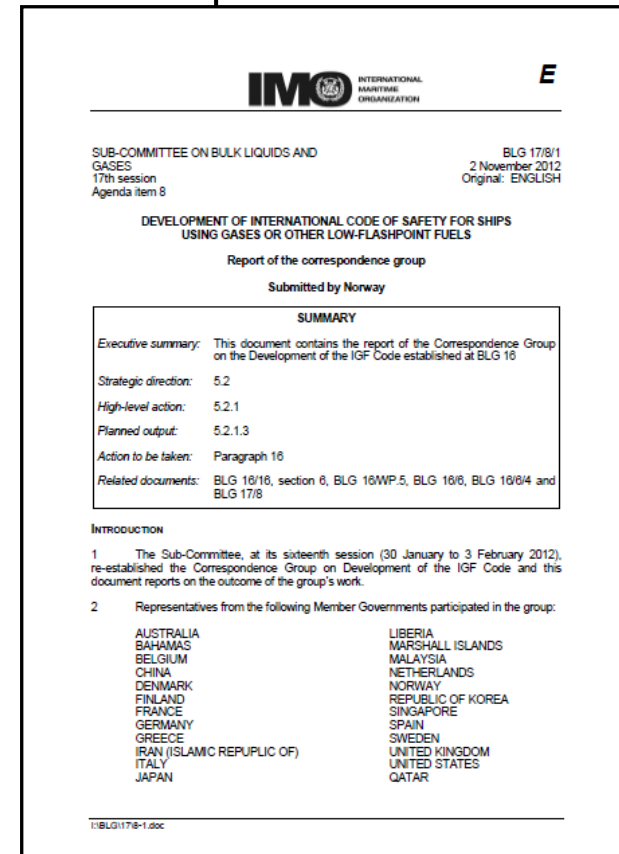
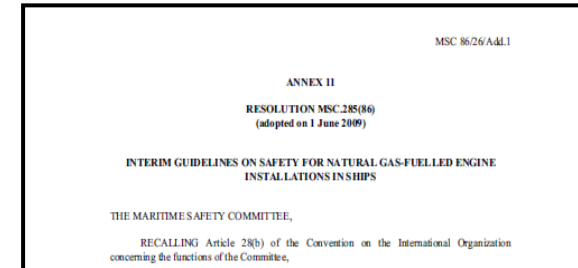
Industry Responses to LNG Fuel

- Industry groups
 - SIGTTO LNG Fuel Safety Advisory Group
 - Intertanko (ISTEC)
 - CIMAC (International Council of Combustion Engines)
- Bunkering standardization – ISO TC67 Working Group 10
- LNG as Fuel Advisory Council (US)



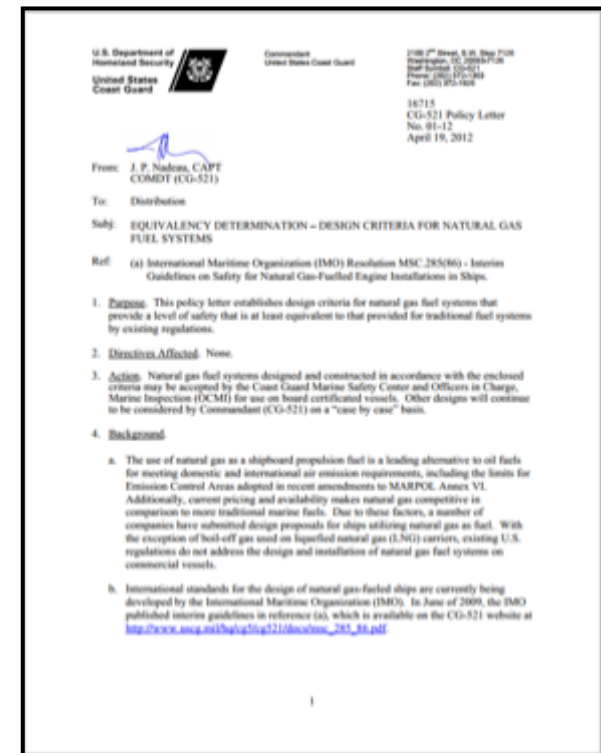
Regulatory Framework: Safety

- IMO Interim Guidelines on Safety for Natural Gas-Fueled Engine Installations in Ships (IMO Res. MSC.285(86))
- IMO International Code for Safety for Ships Using Gases or Other Low Flashpoint Fuels (IGF Code)



USCG Guidance

- USCG has published design criteria in CG-521 Policy Letter No. 01-12 dated 19 April 2012
- Draw a circle around the LNG propulsion system
- Regulations to be appropriate for vessel type and service
- Find middle ground between:
 - LNG carrier requirements fully apply
 - LNG as a fuel (not cargo) as LNG carrier regulations do not apply



Conclusions

- North America is moving fast
 - Cost, availability and environmental sensitivity confluence
- Development there will drive LNG as the dominant alternative
- First orders accelerating interest
- Infrastructure underway
- Regulatory development is maturing
- Success in the US may open doors to wider adoption





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