

# Environmental Managers Association of BC Workshop



## Development of a New Guidance Document for the Design of LNG Marine Terminals in B.C.



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# Guidelines for LNG Marine Terminals in B.C.



## Outline

- Key Drivers and Scope
- Participants
- Timeline/Schedule
- Technical Content
- Summary



# Key Drivers

- Several proposals for LNG Export terminals in British Columbia are currently pending.
- CSA Z276 provides limited guidance for the analysis/design of the associated marine structures (Clause 11.4).
- Regulatory gap identified.
- BCOGC had an immediate need (quicker than normal CSA review process).
- Voluntary participants from industry.
- Funding: BCOGC.



# Project Scope

- This document applies to the engineering analysis and design of permanent near-shore marine structures that provide structural support to components of the LNG facility and moored LNG carriers.
- This document does not apply to:
  - a) unique issues for floating LNG terminals and ship-to-ship transfers; and
  - b) construction requirements; and
  - c) the siting of LNG loading berths, operational issues or LNG topsides supported by the marine structures.

*Note: However there is a general requirements clause that provides guidance to these aspects that are material for consideration during the engineering design of marine facilities.*

# Constraints/Assumptions Express Documents

- Have a limited consensus processes (6 - 9 months development timeframe).
- 30 day public review period.
- No amendments or interpretations provided by CSA or committee participants.
- Supplemental to and potential seed document for insertion into the CSA Z276 standard.

# Volunteer Participants

- BC LNG Alliance
- CAPP
- LNG Canada (Shell – David Veale and Gennaro Esposito)
- PNW LNG (Petronas – Khairul Faizi Osman)
- ExxonMobil (Vern Leder)
- Woodfibre LNG (Lloyd Mendosa)
- Ausenco (Julian Cajiao and Porang Deljoui)
- WorleyParsons (Daniel Leonard)
- SNC Lavalin (Keith Dunbar)
- Moffatt and Nichol (Martin Eskijian, Ron Byres and Pooja Jain)
- BC Oil and Gas Commission (Gouri Bhuyan)
- Prince Rupert Port Authority (Lorne Keller)
- Transport Canada (Andy Allan)
- Department of Fisheries (Tsunami expertise – Richard Thomson)

# Timeline/Schedule

<b>Activity</b>	<b>Timeline</b>
1. Kick off meeting	January 2015
2. 2 <sup>nd</sup> Committee meeting	March 2015
3. 3 <sup>rd</sup> Committee meeting	April 2015
4. Public Review	June 2015
5. Final Committee meeting	June/July 2015
6. Editorial Review	August/Sept. 2015
7. Publication	October 2015

# Table of Contents

- Seed document – LNGTEMS/MOTEMS (California State Lands Commission)
- Comprised of 8 clauses
  - Clause 0 – Introduction
  - Clause 1 – Scope
  - Clause 2 – Reference publications
  - Clause 3 – Definitions and abbreviations
  - Clause 4 - General requirements and layout
  - Clause 5 – Structural analysis/design
  - Clause 6 – Seismic hazards and geotechnical issues
  - Clause 7 – Mooring and Berthing



# Key Areas for Resolution

- Load combinations for Structural Analysis/Design
- Seismic Performance Criteria
- Tsunami Considerations
- Normal, extreme and accidental conditions for mooring
- Geotechnical considerations



# Structural Analysis and Design Methodologies

In order to facilitate various design codes and standards, the guidelines will provide flexibility. Users can use any of the following internationally recognized codes and standards as a basis for design:

- CAN/CSA - ISO 19902 and CSA S6 (with some modifications)
- British/Euro codes (EN 1990 series and BS 6349)
- US codes and standards (MOTEMS, ASCE 61-14, API RP 2A, UFC 4-159-03, UFC 4-152-03).
- Resultant reliability was a consideration and area of much discussion.



# Seismic Performance Criteria

- CSA Z276 provides informative seismic design guidance to design structures and buildings to the NBCC.
- The seismic performance level in the express document is further clarified for to be similar to the safe shutdown event (SSE) for LNG tanks.
- Seismic Performance:
  - 2,475 year return period
  - Safe shutdown of facility
  - Fire protection remains operational

## Geotechnical Considerations

- Seismic Criteria – code-based and probabilistic seismic hazard assessment options.
- Evaluate liquefaction potential, settlement, and other geotechnical hazards.

# Tsunami Considerations and Screening

- Simulations should be performed to establish wave height and run-up and return period based on the source
- It may not be possible to develop return period for land slide generated tsunamis and for this case a pragmatic approach may be adopted to establish the most credible event



# Mooring and Berthing

- Provides guidance for providing mooring analysis and implementing loads in the structural design.
- Mooring analysis based on three conditions: Normal operating, Extreme operating and Accidental
- Considers Sea Level Rise



# Summary

- Proponents now have clear and comprehensive understanding of acceptable approaches to design
- Clarity in terms of:
  - Design considerations,
  - Performance requirements and
  - Accepted national and international standards and best practices
- Effective and efficient process for development of industry best practices
- Document is publicly available at no cost on CSA website
- Z276 technical committee to consider for inclusion into exiting standard.

Questions?