



OTC 18092

Integration of Insulated Rigid and Flexible Cryogenic Pipes in Marine LNG Transfer Systems

P. Cox, Technip France; C. Blair, Aspen Aerogels Inc.; and D. Adkins, Chevron

Copyright 2006, Offshore Technology Conference

This paper was prepared for presentation at the 2006 Offshore Technology Conference held in Houston, Texas, U.S.A., 1–4 May 2006.

This paper was selected for presentation by an OTC Program Committee following review of information contained in an abstract submitted by the author(s). Contents of the paper, as presented, have not been reviewed by the Offshore Technology Conference and are subject to correction by the author(s). The material, as presented, does not necessarily reflect any position of the Offshore Technology Conference, its officers, or members. Papers presented at OTC are subject to publication review by Sponsor Society Committees of the Offshore Technology Conference. Electronic reproduction, distribution, or storage of any part of this paper for commercial purposes without the written consent of the Offshore Technology Conference is prohibited. Permission to reproduce in print is restricted to an abstract of not more than 300 words; illustrations may not be copied. The abstract must contain conspicuous acknowledgment of where and by whom the paper was presented. Write Librarian, OTC, P.O. Box 833836, Richardson, TX 75083-3836, U.S.A., fax 01-972-952-9435.

Abstract

The recent developments of fully insulated Cryogenic Flexibles and rigid Pipe-in-Pipe technologies will rapidly lead to new and innovative architectures for offshore and nearshore LNG installations.

When using these technologies in an integrated LNG Marine Terminal, significant advances directly related to environmental issues can be achieved. By eliminating the need for expansion loops and using a passive insulation system in the pipe-in-pipe, the installation and maintenance of such pipes is greatly simplified and will allow subsea configurations directly linking the offshore to the onshore facilities. Extended trestles and dredging can be eliminated or significantly reduced. Additionally the impact on the coastal transition zone is minimal, both during installation and throughout the lifetime of the project. Offshore or nearshore LNG transfer terminals, at the end of the subsea pipe-in-pipe will be subjected to higher environmental influences and could require a large breakwater to be installed. However by the use of a compliant transfer system with aerial or floating Cryogenic Flexibles, this is no longer needed.

One of the key concerns is the efficient insulation of such pipes and flexibles, to keep boil-off to a minimum, whilst ensuring the safe operational transfer of LNG in marine environments. The use of nanoporous Aerogel is proving to be the optimal solution for this. The development of the floating Cryogenic Flexible poses the greatest challenge, as it will be in a permanent dynamic mode during transfer operations. This aspect is being fully addressed as part of an ongoing Joint Industry Programme. The Pipe-in-Pipe will benefit from the same industrialisation and assembly methods as already qualified for the Oil Industry, and a complete test and certification programme is underway.

Introduction

The move to offshore operations for the LNG Industry is now underway. The installation of process equipment at both ends of the chain, either on fixed or floating supports, has been the object of many studies and proposals, whilst marine LNG transfer systems have been under development for a number of years. Within this overall picture there are three distinct areas of interest:

- Marinisation of liquefaction equipment
- Marinisation of regasification equipment
- Compliant LNG transfer and rigid piping systems

It is evident that these three challenges are intrinsically linked, as the smooth operation of the complete LNG chain is needed to ensure a constant supply of gas to the end customers.

This paper will specifically address the development of compliant LNG transfer systems, how they can influence the siting of nearshore or offshore facilities, and especially the building blocks needed to offer complete solutions. A wide variety of architectures have been proposed to the Industry, many of which are extremely complicated and heavy, and therefore cost and maintenance prohibitive. The opportunity for the LNG Industry to benefit from new technology should not be missed as it can greatly influence project designs and improve economics. However new technology means new challenges, and extensive design, testing and certification of all equipment is required before the Industry will agree to integrate new solutions into their projects.