Engineering Consulting & Training Services

CARMAGEN Engineering, Inc.

eNewsReport

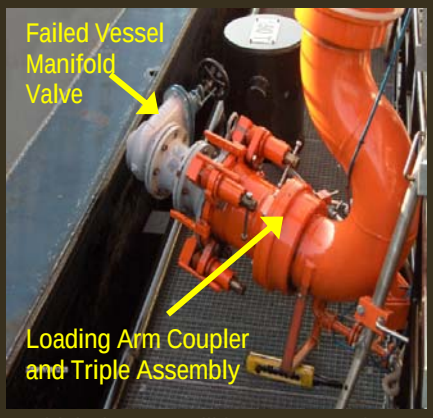
November/December 2012


# How Safe Are Your Docks?

*By James Marcello*

Every year incidents at Marine Terminals cost operating companies hundreds of thousands of dollars in downtime, equipment replacement, and environmental clean-up costs. Outdated marine terminal facilities may also result in longer tanker loading or unloading times which translate to increased costs and potential increased risks. More importantly, many personal injuries and fatalities have occurred which may have been avoided with the right equipment and operating procedures in place.

A case in point: Recently a tanker manifold failed during tanker loading at a European Marine Terminal resulting in a significant pollution incident. This incident most likely would not have occurred had the terminal applied appropriate manifold connection criteria in their operations. Apparently, the terminal was not fully aware of the level of stress a loading arm can place on a ship's manifold, and did not have procedures in place to ensure that these stresses did not exceed the capacity of the manifold.




When designing a marine loading arm, it is critical that the arm be compatible with the manifolds of the vessels to which the arm will be connected to avoid this type of failure. To determine this, the arm manufacturer must conduct a stress analysis of the arm in the worst case connected positions to establish the maximum loads applied to the vessel's manifold.

This analysis is frequently not available unless the owner included this requirement in the technical specifications when the arm was originally purchased. However, for a relatively small fee, the arm manufacturer can usually do the analysis after the fact.

Based on the analysis, the arm manufacturer can provide the owner details on the minimum allowed manifold size (diameter) and maximum allowed manifold cantilever length.

## Upcoming Training Course held in our NJ offices

- Course 607, *Design and Maintenance of Aboveground Atmospheric Storage Tanks*, April 9-11, 2013

See our website for details

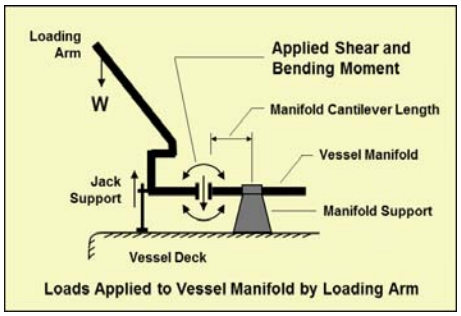
## Work Highlights

### *Mechanical Engineering*

- *Mechanical engineering design audits were made of piping systems, pressure vessels, heat exchangers, and packaged equipment being supplied for onshore and offshore facilities for "upstream" projects. Considerable effort was made to help ensure that the contractors were using appropriate procedures to correct potential acoustically induced piping vibration issues that were identified.*

### *Process, Operations & Safety*

- *Provided patent review and technical consultation regarding fuels hydroprocessing.*
- *Continue to provide facilitator and designer support on numerous HAZOP, project safety review, and Transient Operations HAZOP (TOH) efforts at numerous refinery locations and clients.*

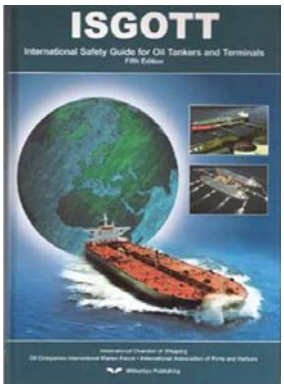



These values can be part of the pre-arrival vetting of the tanker or can be checked by the Dock Operator when the vessel arrives.

Another safety critical area that is often missing or incomplete at marine terminals are Mooring Guidelines which include the number, breaking strength, and layout of mooring lines, as well as maximum wind speeds for stopping operation and draining and disconnecting cargo transfer equipment. Most marine terminals have maximum allowed operating wind speeds, but these limits are often based on rules of thumb or have been decided based on local marine experience and expertise. It is not unusual to find that these allowable wind speeds are too high, sometimes by a significant margin, when an engineering analysis of the mooring arrangements is conducted.

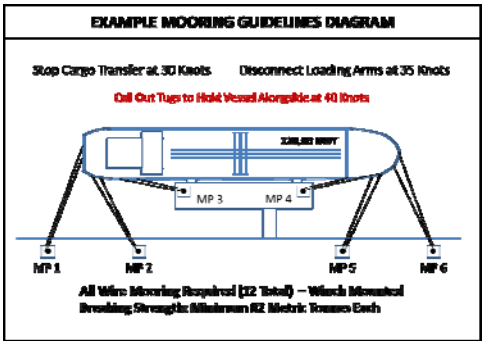
Some terminals take the position that the ship is totally responsible for the safety of the mooring, and leave it up to the ship's Master to decide when to stop cargo transfer or disconnect the cargo transfer equipment. This is a potentially high risk approach to mooring safety. The Master may not be aware of the strength of the shore mooring points, and may not appreciate the local currents which increase the loads on his vessel beyond the wind loads. Should the vessel experience sudden movement in the berth due to high winds, there is a danger that the terminal's cargo transfer equipment can be damaged with resulting pollution, fire, or explosion. Since there is a risk to shore equipment, the terminal must take at least an equal responsibility with the vessel for the safety of the mooring.

The need for formal mooring guidelines based on an engineering analysis is well documented in the *International Safety Guide for Oil Tankers and Terminals* (ISGOTT – 5th Ed., Witherby & Co. Ltd., 2006). There are a number of commercially available software programs for conducting the site-specific mooring analysis that is required to develop mooring guidelines for a terminal.




These include OPTIMOR from Tension Technology International, Ltd. and TERMSIM from the Maritime Research Institute Netherlands (MARIN).

Once a proper analysis has been conducted, a simple diagram can be developed which both the vessel and the dock operator can use as the basis for a safe mooring.




The above discussion on manifold connection criteria and mooring guidelines is only a sampling of the safety critical areas associated with marine terminals.

A marine terminal is one of the highest risk areas at oil refinery and petrochemical facilities. There are a number of factors that contribute to the high level of risk when handling oil tankers or chemical ships.

- Vessels are not part of the site's normal operating regime – they only arrive periodically, and may have not visited the site in the past.
- Vessel personnel are not part of the normal site training programs and will not be intimately familiar with site safety regulations and emergency response procedures.
- Vessels are not subject to the site's normal safety inspections and may not be maintained and operated to the same standards that are applied to the site facility and operations.

Vessels that arrive at a marine terminal are typically third party. Although some vessels may be owned and operated by the same company as the terminal, they typically fall under a different part of the organization or are part of an affiliated company. Bringing a vessel and terminal together for transfer of product combines two different and diverse organizations who may never have worked together before.

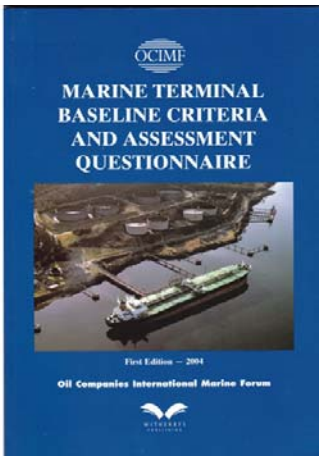
To ensure a safe and efficient cargo transfer operation, the ship and terminal representative (typically the ship's First Officer and the terminal Dock Operator) should conduct a Pre-Transfer Conference for every vessel no matter how

many times it has called at the terminal. Both parties should agree in writing on the transfer procedures and on the actions to be taken in the event of an emergency. The items to be covered in this conference will vary slightly depending on whether loading or unloading operations will take place.

The *International Safety Guide for Oil Tankers and Terminals* (ISGOTT) provides details and checklists for conducting Pre-Transfer Conferences (Section 22.4, Pre-Transfer Exchange of Information).

## Methodology for Determining Safety of a Marine Terminal

Industry groups such as the Oil Companies International Marine Forum (OCIMF) have long recognized the need for standards covering the safe design and operation of marine terminals. In 2004 OCIMF published a guide entitled "*Marine Terminal Baseline Criteria and Assessment Questionnaire*." The introduction states that the "Questionnaire has been published to encourage the uniform assessment of standards of safety and environmental protection at chemical, gas, and oil terminals."




The Questionnaire provides an excellent basis for determining the level of safety at a marine terminal when the assessment is conducted by experienced and knowledgeable specialists in marine terminal equipment and operations. The experts at Carmagen Engineering have conducted numerous technical and operational safety audits at marine terminals all over the world and are ready to assist you in evaluating the safety of your terminal.

A Carmagen Engineering Marine Terminal Safety Audit will typically take from two to five days on site depending on the size of the terminal and complexity of operations. The audit is conducted by a one- or two-man Carmagen Team. The areas to be covered by the audit are agreed beforehand, but typically include the following:

- Management & Organization
- Terminal Layout & Physical Condition
- Ship/Shore Interface
- Cargo Transfer
- Safety, Health, and Fire Protection
- Environmental Protection
- Emergency Preparedness
- Maintenance

At the conclusion of the audit, a formal written report is provided covering both the good points of the terminal and recommendations for improvement.

If requested, Carmagen Engineering can follow-up the audit with qualitative Risk Assessments to assist the terminal management in determining which recommendations have the highest priority for implementation. These risk assessments are typically conducted on site by a team consisting of local site personnel and one or more Carmagen Engineering experts.

Carmagen Engineering is also available to assist in developing technical specifications for terminal modifications to address safety audit recommendations, or for new operational or equipment requirements to improve safety.

## About the Author

*Jim has over 35 years of professional experience with a major multi-national petroleum company working in the field of marine terminal engineering with the focus on port and marine terminal planning, design, construction, and operations. His work experiences covered the broad areas of single point moorings (SPM's), multi-buoy berths (MBB's), conventional docks/piers and sea islands. Jim served as representative on a variety of Oil Company International Marine Forum (OCIMF) industry committees and ad hoc task forces. He led a number of Front End Engineering Design (FEED) activities as well as several cost reduction task forces during early planning that achieved significant project cost reductions.*

*Please contact Vince Carucci (vcarucci@carmagen.com) if you'd like more information on Carmagen's expertise in this area.*