

CHAPTER 8

Alternative and Emerging Technologies

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This chapter describes how alternative and emerging technologies can be assessed to make sure they do not affect safety on tankers and terminals. The due diligence process can be used in the tanker's SMS and safety manuals on the terminal. For more detail on alternative and emerging mooring technologies, see OCIMF's *Mooring Equipment Guidelines*.

8.1 Definition

Alternative technologies are technologies that have a documented track record in another sector but are not yet adopted in the tanker and terminal sector.

Emerging technologies are technologies that do not have a documented track record in any sector but could be developed in the future to improve the safety and the efficiency of the tanker and terminal sector.

In both cases, no known best practice would exist for the tanker and terminal sectors.

8.2 Examples

At the time of publication, the following alternative or emerging technologies exist:

- Marine Autonomous Surface Ships (MASS).
- Autonomous Underwater Vehicles (AUV).
- Marine mobile technology, e.g. intrinsically safe electronic tablets and telephones.
- Aerial drones.
- Robotic crawlers.
- Cold ironing.
- Methanol bunkering.
- Hydrogen fuel cell management.
- Electric cell propulsion power supply.

The list is not exhaustive. This guide does not endorse or oppose the listed technologies, but they may be considered for use following a structured due diligence and formal risk assessment process.

8.3 Due diligence process

8.3.1 Evaluation

Before considering the adoption of an alternative or emerging technology, a preliminary design review should be completed to evaluate the:

- General description and its equivalency to existing technologies.
- Functional description and its equivalency to existing technologies.
- Interface with existing technologies.
- Interface with existing systems and operational processes.
- Preliminary documentation, design drawings, general arrangements, product specifications and applicable codes and standards.
- Detailed formal safety and operational risk assessment plans, including assessments of human factors.
- Any additional design basis documentation.
- Consistency with other industry reference materials, e.g. the World Association for Waterborne Transport Infrastructure (PIANC) or the International Association of Classification Societies (IACS).

8.3.2 Impact

The tanker and terminal should complete an impact assessment before agreeing to use an alternative or emerging technology at the marine interface. This process should be documented and ensure that both parties have assessed and understood the risks of using the alternative or emerging technology.

If either the tanker or terminal is unable to complete the impact assessment, they should tell the other party what technology is being used and share any relevant documentation to support its use, e.g. the risk assessment and evaluation reports of design and product specifications.

If the alternative or emerging technology only affects the tanker or the terminal, the above exchange does not need to happen unless a general understanding would be useful.

8.3.3 Equivalency

Equivalency should be demonstrated through detailed data analysis of engineering or design studies, prototype and/or on-site testing and experience. Compare the data analysis of the alternative or emerging technology with the existing technology it is replacing or being used alongside.

Equivalency should show that the alternative or emerging technology is at least as good as the existing technology in delivering:

- The safety of tanker and terminal personnel.
- The assurance that the risks continue to be effectively managed.
- Suitable margins of safety that include the probability and consequence of system failure.
- Operational effectiveness and integrity.
- Compliance with applicable regulations, standards and recommended industry guidance and best practices.

8.3.4 Formal safety risk assessments

Formal, documented and detailed safety risk assessments should be carried out to understand the risks of using alternative or emerging technologies. It is recommended that personnel conducting these risk assessments:

- Are experienced in the methods of risk assessment being used.
- Have a detailed working knowledge of the alternative or emerging technology, the equivalent existing technology and industry best practices.

Classification Societies, marine consultants or other organisations may provide an independent formal safety risk assessment or guidance on how to effectively evaluate alternative and emerging technologies.

The IMO also provides guidance to administrations for approving alternatives and equivalents in MSC.1/Circ.1455 *Guidelines for the Approval of Alternatives and Equivalents as Provided for in Various IMO Instruments*.

Factors to consider in a formal safety risk assessment of an alternative or emerging technology include:

- Hazards associated with the alternative or emerging technology and/or its equivalency.
- Safeguards incorporated into the design of the alternative or emerging technology, including measures to ensure the safety of personnel.
- Human factors and any risk reducing benefits from adopting the alternative or emerging technology.
- Risk modelling to identify frequencies and potential consequences of hazards.
- Risks related to the local conditions and locally required operations.
- Issues that may require further detailed analysis and testing/evaluation.
- Issues that may require special attention with respect to operations, inspection and maintenance, including personnel, equipment and systems redundancy.
- How the alternative or emerging technology works under different environmental conditions, e.g. air temperature, marine spray or ice.

8.3.5 Stakeholder engagement

The number and type of stakeholders involved in evaluating an alternative or emerging technology will depend on its impact and the complexity of its implementation.

Stakeholder mapping is recommended for identifying stakeholders who are important to the evaluation and success of the alternative or emerging technologies.