

FUEL SAFETY FRAMEWORKS

Ammonia

Building the Bases of Safe Operations

IMO technical seminar on the use of ammonia as a marine fuel
17 September 2026

Tom Chitseko Lloyd's Register Maritime Decarbonisation Hub



Mærsk Mc-Kinney Møller Center
for Zero Carbon Shipping



Our team



Mærsk Mc-Kinney Møller Center
for Zero Carbon Shipping

Developed with partners:



Challenge and response



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Ammonia can be safely managed - if industry addresses design and human factors challenges

Reference design



Key findings

Competency & Training

New skills and knowledge will need to be developed for many roles.

Work Process & Procedures

There will be numerous changes to, and increased reliance upon, functional work practices and procedures.

Occupational Health Hazards

Restrict access to- and reduce time spent in spaces containing ammonia equipment.
Remote monitoring .

Process Safety Hazards

Managing high standards of safety will require companies to further develop their standards of planning, emergency preparedness, and maintenance as guided by the ISM Code.

Rating of Human Factors domains

Low

Roles & Responsibilities

Resourcing & Personnel

Medium

Ergonomics Design

Management of Change

High

Competency & Training

Process Safety Hazards

Process & Procedures

Occupational Safety

Ammonia readiness also means qualifying the organisation and its people

The ship

Interim guidelines for the safety of ships using ammonia as fuel (MSC.1/Circ.1687 and MSC.1/Circ.1702, approved Dec 2024 and May 2026)

Progressing

The seafarer

Interim guidelines on training for seafarers on ships using ammonia as fuel (STCW.7/Circ.27, approved May 2026)

Progressing

The operating organisation

How operators organize to control major-accident hazards day-to-day

Current focus

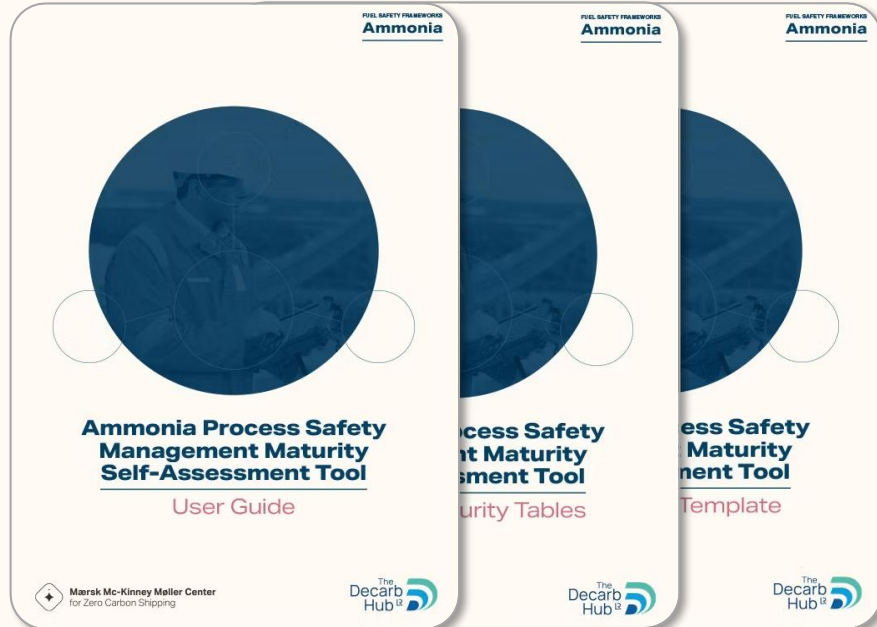
Three questions an operator has to answer

Where do we begin?

What should we focus on?

How do we know we are ready?

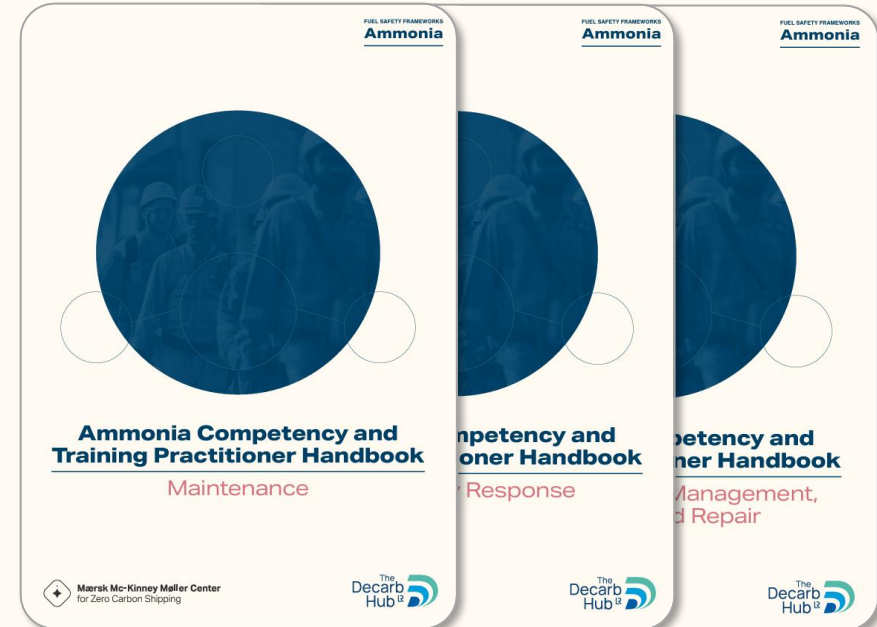
Released this August



RESPONSE1: AT THE ORGANISATIONAL LEVEL

Process Safety Management Maturity Self-Assessment Tool

- User Guide
- Element Maturity Tables
- Assessment Template (PDF and Excel)



RESPONSE2: AT THE INDIVIDUAL LEVEL

Three Competency and Training Practitioner Handbooks

- Emergency Response
- Maintenance
- Leak Detection, Management, Isolation and Repair

Response 1: The Process Safety Management Maturity Self-Assessment Tool



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PSM: A proven safety management approach, borrowed from sectors with a track record of controlling major hazards

Process safety: “keeping the process in the pipe”

- **Concerned with major hazards**
Directed at control of hazards that can give rise to catastrophic events
- **The whole hazard control arc**
Prevention, preparedness, mitigation, response and restoration.
- **Integrative by design**
Spans design, technical, operational and leadership integrity, and concerned with these functioning as an integrated whole.

A learning framework

16 elements drawn from the CCPS Risk-Based Process Safety Management framework, each described across 5 maturity bands:

Ad-hoc

Reactive

Standardised

Proactive

Generative

Intended to help understand the organization's maturity level, not to 'score' it.

Bands are indicative descriptors. The main value is derived from the evaluative process associated with making a maturity assessment.

A maturity gradient to support readiness decisions.

The ultimate decision that an operation is ready for ammonia belongs with operators and regulators. However, higher PSM maturity corresponds to a higher likelihood of being organisationally ammonia ready.

Enables risk-based prioritisation of action.

Maturity is not an average across elements and different elements can carry different priorities in different contexts. The tool provides a flexible but structured basis for evaluating operational safety and prioritising improvement action.

What an assessment produces

PSM Category: Manage Risk

ILLUSTRATIVE ONLY

Element	Element goal	Maturity band	Remarks (Evidence/ Next Steps/ Priority)
Safe Work Practices	Safety practices for hazardous work are developed and consistently implemented to assure the safety of those affected by the work, as well as the integrity of the assets involved.		Evidence: Document review and observation: permit-to-work system in use, but permits do not require confirmation that fixed and portable gas detection is available, in calibration and functioning before work begins on or adjacent to fuel systems. Next steps: Add verification of detection, ventilation and alarm availability to the permit for ammonia-system work. Align the isolation register to current P&IDs. Priority: P1
Asset Integrity and Reliability	Technical system assets are designed, installed and maintained to operate safely throughout their lifecycle.		Evidence: Audit record: PMS in place but intervals inconsistently followed; no functional checks on safeguard efficacy. Ammonia weak links not yet identified. Next steps: To reach Standardised: identify and control known weak links - valves, seals, gaskets - through inspection and maintenance, proactive leak detection. Incorporate in PMS procedures. Record and risk-assess any temporary impairment of detection. Priority: P1 - risk-critical element

Bands: Ad-hoc Reactive Standardised Proactive Generative

Response 2: The Competence & Training Practitioner Handbooks



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Role-specific competencies, ship and shore

The approved interim guidelines set the training baseline for seafarers. These handbooks map competencies to scenarios and roles (sea-going and shore-based) to provide a clear indication of who needs to know what under which circumstances.

Leak Detection, Management, Isolation and Repair

18 competencies in 7 groups

Maintenance

28 competencies in 6 groups

Emergency Response

116 competencies in 10 groups

Every competency is tagged to roles on both sides of the ship-shore interface

SHIPBOARD

- Management — Master, C/E, C/O, 1/E
- Operations — junior officers
- Support — other seafarers

SHORE-BASED

- Corporate — operations, technical, safety, DPA
- Management — Port Authority
- Operations — terminals, shoreside responders
- Support — bunker barges, reception facilities, salvors

An illustrative competency

Portable detectors

Competency 3.2



Understanding of situations in which gas detection is required and of the functioning of **portable and personal ammonia gas detectors**.

Training standard

- i. Knowledge of circumstances under which ammonia gas detection is required, including routine, abnormal, and emergency conditions.
- ii. Understanding of the operating principles, correct use, and operational limitations of portable and personal ammonia gas detectors.
- iii. Understanding of the interpretation of ammonia concentration readings and associated alarm levels.

Shipboard roles

Management

Operations

Support

Shore-based roles

Corporate

Management

Operations

Support

Each entry has four parts

1. **The competency** — what the person has to be able to do
2. **The training standard** — the specific requirements that satisfy it
3. **Level of competence** — the weighting of knowledge, understanding and proficiency
4. **Role applicability** — tagged across ship and shore

Training requirements scaled in proportion to responsibility and exposure to risk.

Over to you...



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Where this might be useful to you

Operators

A structured, non-prescriptive way to answer 'where do we begin' when maturing safety management organisations to make them ready for ammonia.

Port authorities and terminals

Shore-side competencies for ammonia identified and mapped.

Training providers

Role-differentiated competency sets to support building of modular training programmes today.

→ A shared vocabulary to help first movers and those with adjacent experience refine best practice together.

Our invitation

1

Use them

Wherever ammonia competency and organisational readiness are being worked on.

2

Share them

Applicable beyond first-mover contexts.

3

Help us improve them

Feedback routes are included in every publication. We expect that this guidance will be revised/ updated.

Engage here:



Thank you

Questions welcome

PSM Maturity Self-Assessment Tool · Practitioner Handbooks



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