



Horizon 2020  
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MG-2.2-2018: Marine Accident Response, Subtopic C

## 1 Recommendations for decision-making

This document provides the draft text for recommendations for decision-making, i.e., proposals for IMO regulation amendments, in a way to be presentable at IMO.

Note 1: It should be noted that the application scope (passenger or cargo ship, new or existing ship) and application dates are left to the final text that may be submitted to IMO.

Note 2: It should be noted that the following proposals for regulations were developed while the conclusions of MSC107 were not yet reported. Therefore, they were based on text from the SSE Sub-Committee and, due to time constraint, were not updated based on potential revisions from MSC107.

Note 3: RCOs were not considered in combination in LASH FIRE and the amendment proposals for RCOs can therefore not be proposed in combination without having checked the interdependency matrix in the Annex (page 38) and having re-done the quantitative assessment of the combination of RCOs (when needed).

Note 4: In the following, it was decided to draft the different proposals based on the planned SOLAS amendments, as detailed in SSE 9/20 Annex 5 and 6. It is a liberty taken by LASH FIRE, even though those draft amendments were not considered in the risk and cost-effectiveness assessment. The readers should be aware of this limitation when using the following proposals.

### 1.1 RCO1: Improved Fire patrols, fire confirmation & localization

#### 1.1.1 SOLAS Ch. II-2 Reg. 20.4

*This amendment proposal is based on SOLAS Ch. II-2 as planned to be amended as per SSE 9/20 Annex 5.*

*The existing section 4.3 is amended, as follows, the new section 4.4 is added after the existing section 4.3 and the subsequent paragraphs are renumbered accordingly:*

#### 4.3 Special category spaces

~~4.3.1 An efficient fire patrol system shall be maintained in special category spaces.~~

~~4.3.2~~ Manually operated call points shall be spaced so that no part of the space is more than 20 m from a manually operated call point, and one shall be placed close to each exit from such spaces.

#### 4.4 Fire patrols

4.4.1 An efficient fire patrol system shall be maintained in vehicle and ro-ro spaces.

4.4.2 Each member of the fire patrol shall be provided with:

- .1 a two-way portable radiotelephone apparatus with push to talk button;

.2 a flashlight; and

.3 a portable thermal imaging device suitable for screening, detection of hot areas and overheating electrical equipment upon suspicion, and to confirm fire.

**4.4.3** Not less than the 85% of the vehicle and ro-ro space areas, fully loaded with cargo, shall have radio coverage.

#### **4.45 Video monitoring**

1.1.2 SOLAS Ch. II-2 Reg. 15

*The following new section 4 is added after the existing section 3 (Additional requirements for passenger ships):*

#### **4 Additional requirements for ro-ro ships**

**4.1** The training manual shall provide general awareness of fire hazards in vehicle and ro-ro spaces.

**4.2** The training manual shall explain procedures for fire confirmation and localization in vehicle and ro-ro spaces.

1.1.3 SOLAS Ch. II-2 Reg. 16

*The following new section 4 is added after the existing section 3 (Additional requirements for tankers):*

#### **4 Additional requirements for ro-ro ships**

The fire safety operational booklet referred to in paragraph 2 shall include provisions for fire confirmation and localization in vehicle and ro-ro spaces.

1.1.4 SOLAS Ch. III Reg. 19.3.5

*The new paragraphs 3.5.4 and 3.5.5 are added after the existing paragraph 3.5.3:*

**3.5.4** The use of IMO Standard Marine Communication Phrases\* shall be practiced during the fire drills.

**3.5.5** In vehicle and ro-ro spaces, each fire drill shall include manual fire confirmation and localization activities.

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\*Refer to IMO Standard Marine Communication Phrases (resolution A.918(22)).

1.1.5 STCW Code Ch. V

*The following new section A-V/5 is added after the existing section A-V/4 (Mandatory minimum requirements for the training and qualifications of masters and deck officers on ships operating in polar waters):*

#### **Section A-V/5**

*Mandatory minimum requirements for the training and qualification of masters, officers, ratings and other personnel on ro-ro ships*

#### **Standard of competence**

**1** Every candidate for certification in basic training for ro-ro ships shall be required to:

.1 demonstrate the competence to undertake the tasks, duties and responsibilities listed in column 1 of Table A-V/5-1; and

.2 provide evidence of having achieved:

.1 the minimum knowledge, understanding and proficiency listed in column 2 of Table A-V/5-1; and

.2 the required standard of competence in accordance with the methods for demonstrating competence and the criteria for evaluating competence tabulated in columns 3 and 4 of Table A-V/5-1.

**Table A-V/5-1**

*Specification of minimum standard of competence in basic training for ro-ro ships*

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
<p>Minimize the risk of fire and maintain a state of readiness to respond to emergency situations involving fire</p>	<p>Organization of effective fire patrols:</p> <ul style="list-style-type: none"> <li>.1 identification of cargo with highest potential fire hazards</li> <li>.2 critical zones to be inspected by fire patrol</li> <li>.3 potential fire hazards to look out for</li> </ul> <p>Localization and confirmation of a fire:</p> <ul style="list-style-type: none"> <li>.1 localization and approaching of a potential fire in a safe way.</li> <li>.2 manual confirmation of existence of fire</li> <li>.3 emergency communication according to IMO Standard Marine Communication Phrases</li> <li>.4 decision on appropriate first response techniques</li> </ul>	<p>Assessment of evidence obtained from approved instruction or attendance at an approved course</p>	<p>Initial actions on becoming aware of an emergency conform with accepted practices and procedures.</p> <p>Action taken on identifying and confirming fire is appropriate to the indicated emergency and complies with established procedures</p>

## 1.2 RCO2: Signage and markings for effective wayfinding and localization

### 1.2.1 SOLAS Ch. II-2 Reg. 15

*The following new paragraphs 2.3.5, 2.4.3 and 2.4.4 are added after the existing paragraphs 2.3.4 and 2.4.2:*

### 2.3 Training manuals

[...]

**2.3.5** For ro-ro ships where fixed pressure water-spraying systems are fitted in ro-ro or vehicle spaces, the training manual shall include fixed pressure water-spraying system section and deck numbering.

### 2.4 Fire control plans

[...]

**2.4.3** For ro-ro ships where fixed pressure water-spraying systems are fitted in ro-ro or vehicle spaces, the fire control plans shall include fixed pressure water-spraying system section and deck numbering.

**2.4.4** In general, decks shall be numbered in a simple and straightforward way by means of numbers or letters, and these references should be used throughout all onboard instructions and marking without mixing them with deck or system specific names or numbers.

### 1.2.2 SOLAS Ch. II-2 Reg. 20.4.4.1

*This amendment proposal is based on SOLAS Ch. II-2 as planned to be amended as per SSE 9/20 Annex 5.*

*The existing paragraph 4.4.1 is amended, as follows:*

**4.4.1** For passenger ships, an effective video monitoring system shall be arranged in vehicle, special category and ro-ro spaces for continuous monitoring of these spaces. The system shall be provided with immediate playback capability to allow for quick identification of fire location, as far as practicable, and shall allow for instant identification of which drencher zones are visible from each camera. Cameras shall be installed to cover the whole space, high enough to see over cargo and vehicles after loading.

### 1.2.3 SOLAS Ch. II-2 Reg. 20.7

*This amendment proposal is based on SOLAS Ch. II-2 as planned to be amended as per SSE 9/20 Annex 5.*

*The existing paragraph 7 is amended, as follows:*

## 7 Decision-making

In passenger ships, vehicle, special category and ro-ro spaces, where fixed pressure water-spraying systems are fitted, shall be provided with suitable easily identifiable signage and markings<sup>8</sup> on deckhead and bulkhead and on the vertical boundaries allowing easy identification of the sections of the fixed fire-extinguishing system. Suitable signage and markings shall be adapted to typical patterns of crew movement and fire patrol pattern, taking into consideration obstruction by cargo or fixed installations. Fire patrols should be able to visually confirm what section they are in from any position along the patrol route without moving more than 3 m along their route. Section number

signs shall be of photoluminescent material.\* The section numbering indicated inside the space shall be same as section valve identification and section identification at the safety centre or continuously manned control station.

<sup>§</sup>Refer to ISO 24409-01:2020: Ships and marine technology — Design, location and use of shipboard safety signs, fire control plan signs, safety notices and safety markings — Part 1: Design principles.

\*Refer to chapter 11 of the FSS Code for the evaluation and testing of photoluminescent material.

### 1.3 RCO3: Efficient first response.

#### 1.3.1 SOLAS Ch. II-2 Reg. 16

*The following new section 4 is added after the existing section 3 (Additional requirements for tankers):*

#### **4 Additional requirements for ro-ro ships**

The fire safety operational booklet referred to in paragraph 2 shall include provisions for early response to fire occurring in vehicle and ro-ro spaces and shall include how to raise the fire alarm, how to use portable fire extinguishers and more advanced procedures for crew members who are designated for early response activity to fire occurring in vehicle and ro-ro spaces.

#### 1.3.2 STCW Code Ch. V

*The following new section A-V/5 is added after the existing section A-V/4 (Mandatory minimum requirements for the training and qualifications of masters and deck officers on ships operating in polar waters):*

#### **Section A-V/5**

*Mandatory minimum requirements for the training and qualification of masters, officers, ratings and other personnel on ro-ro ships*

#### **Standard of competence**

**1** Every candidate for certification in basic training for ro-ro ships shall be required to:

**.1** demonstrate the competence to undertake the tasks, duties and responsibilities listed in column 1 of Table A-V/5-1; and

**.2** provide evidence of having achieved:

**.1** the minimum knowledge, understanding and proficiency listed in column 2 of Table A-V/5-1; and

**.2** the required standard of competence in accordance with the methods for demonstrating competence and the criteria for evaluating competence tabulated in columns 3 and 4 of Table A-V/5-1.

**Table A-V/5-1**

*Specification of minimum standard of competence in basic training for ro-ro ships*

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
<p>Apply effective first response techniques in the event of a fire alarm</p>	<p>First actions after fire detection:</p> <ul style="list-style-type: none"> <li>.1 raising the alarm.</li> <li>.2 use of standard communication phrases</li> <li>.3 self-protection.</li> </ul> <p>First response techniques:</p> <ul style="list-style-type: none"> <li>.1 use of portable heat camera</li> <li>.2 use of different types of portable fire extinguishers</li> <li>.3 basic fire-fighting skills</li> </ul> <p>General safety awareness:</p> <ul style="list-style-type: none"> <li>.1 mental and physical preparedness for efficient first response</li> <li>.2 familiarization with vessel, access ways and limitations, marking of drencher zones etc.</li> </ul>	<p>Assessment of evidence obtained from approved instruction or during attendance at an approved course, including practical demonstration in spaces which provide truly realistic training conditions</p>	<p>The timing and sequence of individual actions are appropriate to the prevailing circumstances and conditions</p> <p>First response to a fire is achieved using appropriate procedures, techniques and fire-fighting agents</p>

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
	.3 familiarity with available means of fire-fighting, personal protection equipment		



## 1.4 RCO4: Manual firefighting for Alternatively Powered Vehicles

### 1.4.1 SOLAS Ch. II-2 Reg. 15

*The following new section 4 is added after the existing section 3 (Additional requirements for passenger ships):*

#### **4 Additional requirements for ro-ro ships**

Relevant crew members shall be trained to be familiar with fire-fighting activities and risks associated with new energy vehicles such as battery or gas driven vehicles.

### 1.4.2 SOLAS Ch. II-2 Reg. 20.6

*This amendment proposal is based on SOLAS Ch. II-2 as planned to be amended as per SSE 9/20 Annex 5.*

*The following new section 6.4 is added after the existing section 6.3 (Portable fire extinguishers) – note: application dates to be agreed by IMO Member States:*

#### **1. Fire-extinguishing arrangements in vehicle and ro-ro spaces**

(The requirements of this section shall apply to ships constructed on or after [1 January 2030]. Passenger ships and vehicle carriers constructed before [1 January 2030] shall comply with the requirements of this section not later than the first survey after [1 January 2032].)

2. Ships shall carry, in addition to the equipment and arrangements required in paragraphs 6.1, 6.2 and 6.3, at least:

.1 one water mist lance;

.2 one fire blanket; and

.3 one boundary cooling device.

**6.4.2** The water mist lance shall consist of a tube with a piercing nozzle which is capable of penetrating a vehicle and producing water mist inside the vehicle when connected to the fire main.

**6.4.3** The fire blanket shall consist of a fire-retardant blanket, covering the whole vehicle, which can be used as a preventive measure, capable of mitigating fire spread to an adjacent vehicle, and during post extinguishment, capable of hindering re-ignition and containing gas emissions.

**6.4.4** The boundary cooling device shall consist of a mobile pipe or rail of specifically oriented water spray nozzles which is capable of preventing fire spread from one car to adjacent vehicles when connected to the fire main.

**6.4.5** Ships shall develop a maintenance plan for:

.1 water mist lance.

.2 fire blanket; and

.3 boundary cooling device.

#### **3. Fire-fighter's outfits**

(The requirements of this section shall apply to ships constructed on or after [1 January 2030]. Passenger ships and vehicle carriers constructed before [1 January 2030] shall comply with the requirements of this section not later than the first survey after [1 January 2032].)

**6.5.1** The additional personal equipment as regards as manual fire-fighting for new energy vehicles shall comply with section 2.3 of chapter 3 of the Fire Safety Systems Code.

**6.5.2** Ships shall carry at least two sets of the additional personnel equipment.

**6.5.3** The sets of additional personal equipment shall be kept ready for use in an easily accessible location that is permanently and clearly marked, together with the rest of the fire-fighter's outfits.

#### 1.4.3 FSS Code Ch. 3

*The following new section 2.3 is added after the existing section 2.2 (emergency escape breathing devices (EEBD)) – note: application dates to be agreed by IMO Member States:*

### **2.3 Personal protection for ro-ro spaces and vehicle spaces**

This section details the additional specification of personal protection equipment on ro-ro ships as regards as manual firefighting for new energy vehicles. The requirements of this section shall apply to ro-ro ships constructed on or after [1 January 2030]. Ro-ro passenger ships and vehicle carriers constructed before [1 January 2030] shall comply with the requirements of this section not later than the first survey after [1 January 2032].

#### **2.3.1 Personal equipment**

**2.3.1.1** Personal equipment shall consist of the following:

- .1 flash hood to ensure that neck and head are protected.
- .2 long sleeved clothing under the protective clothing required in paragraph 2.1.1.1.
- .3 wristlets with a loop around the thumb to stop sleeves from going up to reduce skin exposure;
- .4 pre-bent knees and elbows to improve mobility; and
- .5 knee pads to allow crawling on hot or hard surfaces.

**2.3.1.2** The protective clothing required in paragraph 2.1.1.1 shall comply with EN 469:2020 level 2 (X2 Y2 Z2), or equivalent.

#### 1.4.4 STCW Code Ch. V

*The following new section A-V/5 is added after the existing section A-V/4 (Mandatory minimum requirements for the training and qualifications of masters and deck officers on ships operating in polar waters):*

### **Section A-V/5**

*Mandatory minimum requirements for the training and qualification of masters, officers, ratings and other personnel on ro-ro ships*

#### **Standard of competence**

**1** Every candidate for certification in basic training for ro-ro ships shall be required to:

- .1 demonstrate the competence to undertake the tasks, duties and responsibilities listed in column 1 of Table A-V/5-1; and
- .2 provide evidence of having achieved:

**.1** the minimum knowledge, understanding and proficiency listed in column 2 of Table A-V/5-1; and

**.2** the required standard of competence in accordance with the methods for demonstrating competence and the criteria for evaluating competence tabulated in columns 3 and 4 of Table A-V/5-1.

**2.** Seafarers designated to control fire-fighting operations of new energy vehicle fire shall have successfully completed advanced training in techniques for fighting new energy vehicle fire, with particular emphasis on organization, tactics and command, and shall be required to demonstrate competence to undertake the tasks, duties and responsibilities listed in column 1 of Table A-V/5-2.

**3.** The level of knowledge and understanding of the subjects listed in column 2 of Table A-V/5-2 shall be sufficient for the effective control of fire-fighting operations of new energy vehicle fire on board ship.

**4.** Every candidate for certification of advanced firefighting of new energy vehicle fire shall be required to provide evidence of having achieved the required standard of competence, in accordance with the methods for demonstrating competence and the criteria for evaluating competence tabulated in columns 3 and 4 of Table A-V/5-2.

**Table A-V/5-1**

*Specification of minimum standard of competence in basic fire fighting of new energy vehicle fire for ro-ro ships*

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
<p>Identify the hazards associated with carriage of new energy vehicles and charging of electric vehicles</p>	<p>Knowledge of the different types of new energy vehicles</p> <p>Ability to identify new energy vehicles, the location of the energy storage system, gas vent (if any) and establish cargo separation procedures.</p> <p>Knowledge of possible consequences of overcharging, fast charging, charging damaged battery</p> <p>Knowledge of the procedures to charge on board electric cars, risks associated and possible mitigation actions</p>	<p>Assessment of evidence obtained from approved training and/or instruction</p>	<p>Quantitative Risk Assessment to estimate the likelihood of fire or thermal runaway when electric vehicles are loading on board.</p>

**Table A-V/5-2**

*Specification of minimum standard of competence in advanced firefighting of new energy vehicle fire for ro-ro ships*

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Organize and control methods and equipment for fire-fighting operations of new energy vehicle fire on board ro-ro spaces	<p>Basic knowledge on suppression systems needed in case of fire-fighting operations of new energy vehicle fire on board ro-ro spaces.</p> <p>Ability to perform fire-fighting technics and tactics regarding new energy vehicle fires</p>	Assessment of evidence obtained from approved training by practical demonstration, shipboard training drill or instruction	<p>Correct installation of cooling devices for the attenuation of radiant heat with the aim of producing a blockage effect</p> <p>Correct selection of the right manual fire-fighting tactic (defensive or offensive) depending on how the fire can be reached considering fire size and potential dangers</p>

## 1.5 RCO5: Improved alarm system interface

### 1.5.1 FSS Code Ch. 9

*This amendment proposal is based on FSS Code Ch. 9 as planned to be amended as per SSE 9/20 Annex 6.*

*The existing paragraph 2.5.1.2 is amended, as follows:*

**2.5.1.2** On ro-ro passenger ships constructed on or after 1 January 2026, alarm notifications shall follow a consistent alarm presentation scheme (wording, vocabulary, colour and position). Both the design of the panel and its integration on board shall take into account the guidelines developed by the Organization\*. Alarms shall be immediately recognizable on the navigation bridge and shall not be compromised by noise or poor placing.

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\*Refer to the design guidelines for fixed fire detection and fire alarm panels and their integration on board (MSC.1/Circ.XXXX).

### 1.5.2 New MSC.1/Circ.XXXX: Design guidelines for fixed fire alarm detection and fire alarm panels and their integration on board

*Add the following Annex to MSC.1/Circ.XXXX:*

#### **ANNEX**

#### **DESIGN GUIDELINES FOR FIXED FIRE DETECTION AND FIRE ALARM PANELS AND THEIR INTEGRATION ON BOARD**

##### **1 General**

**1.1** The present Guidelines contains design principles meant to outline how properties of the working environment relate to task performance. The principles are sorted into categories representing different levels of design consideration, reflecting the structure used throughout the guidance documentation.

**1.2** These design principles are based on insights from fire management studies on ro-ro ships, and more principles may be relevant for other cases. The relevance of each principle may vary throughout the ship design project and all may not be applicable at once.

##### **2 Application**

These guidelines are intended to apply to new ro-ro ships.

##### **3 Usability**

**.1** Text-based information should be clear and informative.

**.2** Graphics should replace text when appropriate.

**.3** Graphics (e.g., GA) should contain only relevant information.

**.4** Safety systems should be easy to read and control.

**.5** A consistent naming practice should be applied in all systems and documents.

**.6** Clutter (e.g., paper handling) should be minimized.

**.7** It should be possible to assess the source and validity of information, especially information that has been aggregated from different sources.

## 4 Layout & integration

- .1 There should be room for parallel activities.
- .2 Disturbances between work groups should be minimized.
- .3 The placement and layout of workstations should enable collaboration between work groups (e.g., evacuation and OOW).
- .4 Panels and controls should be placed in a way that promotes an efficient workflow.
- .5 Resources that must be used together should be placed together – consider integrating information and controls for different systems where it benefits efficiency and effectiveness.
- .6 It should be possible to quickly get an overview of all system statuses.

## 5 Collaboration

- .1 Information sharing with other parties (e.g., ECR and fire groups) should be supported.
- .2 Systems should provide information that is easy to communicate to others.
- .3 Events and developments in other working groups should be easy to monitor.
- .4 Work delegation should be supported, e.g., to relieve the fire chief.

### 1.6 RCO6: Process to ensure efficient activation of extinguishing system

#### 1.6.1 SOLAS Ch. III Reg. 19.3.5

*The following new paragraph 3.5.4 is added after the existing paragraph 3.5.3:*

**3.5.4** The fire drills shall take into account the guidelines developed by the Organization\*, as appropriate.

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\*Refer to guidelines for improving procedures and design for activation of fixed fire-extinguishing system in ro-ro spaces (MSC.1/Circ.XXXX).

#### 1.6.2 New MSC.1/Circ.XXXX: Guidelines for improving procedures and design for activation of fixed fire-extinguishing system in ro-ro spaces.

*Add the following Annex to MSC.1/Circ.XXXX:*

## ANNEX

### **GUIDELINES FOR IMPROVING PROCEDURES AND DESIGN FOR ACTIVATION OF FIXED FIRE-EXTINGUISHING SYSTEM IN RO-RO SPACES**

#### **1 Introduction**

Successful management of fixed fire-extinguishing systems in fire situations in ro-ro ships requires both efficiency and thoroughness from the crew involved in the firefighting. Efficiency relates to the swiftness of the activation process, and thoroughness relates to doing things in a right and safe way, e.g., following the established procedures and activating the extinguishing system in the right location of the ship.

#### **1.1 Purpose**

**1.1.1** These guidelines present a Reflection, evaluation and change (REC) process designed to adapt and improve existing procedures and design relating to fixed fire-extinguishing systems management. The process should be carried out at the level of individual ships, preferably in collaboration with the onshore organisation, e.g., with participation from the Designated person ashore (DPA). This to ensure continuity across the process, from discovering improvement potentials during a fire drill, to implementing suggested changes in design or procedures.

**1.1.2** A premise for the REC process is that there exists substantial tacit knowledge in the ship organization, through which ship crews shoulder risks associated with suboptimal designs and procedures. Such tacit knowledge is instrumental in coping with both routine work and for improvisation when faced with surprises. The purpose of the REC process is to make such tacit knowledge explicit through reflection, to evaluate needs for change, and to implement suggested/necessary changes (see Fig. 1).

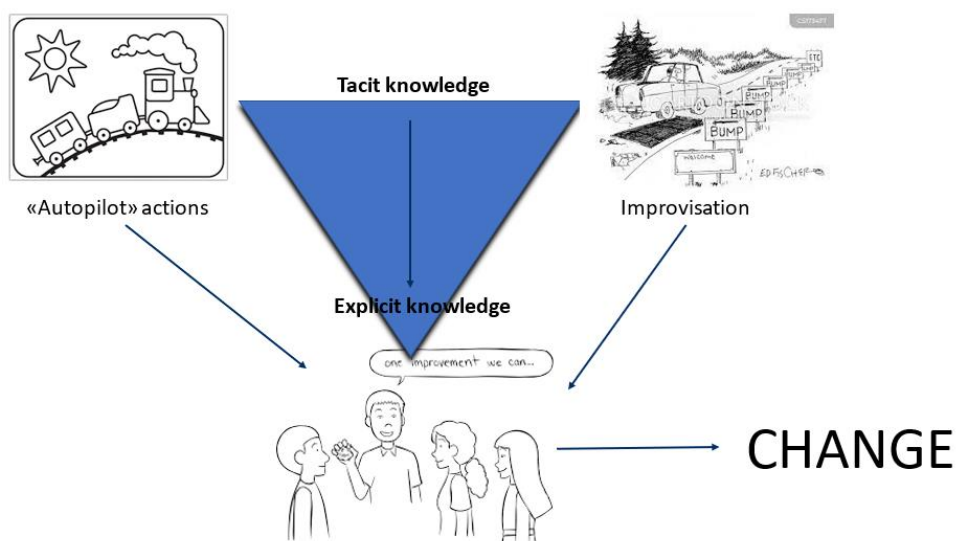


Fig. 1: REC process.

**1.1.3** The REC process should be run with a particular focus relating to fixed fire-extinguishing system activation, that should alternate from each time. Examples of foci could be decision-making and activation; communication; design of instructions materials; roles and responsibilities (coordination).

## 1.2 Intended recipients

The intended recipients of these guidelines are:

- .1 Those onboard the ship involved in fire management, the Master and the fire commander typically being 'super users'; and
- .2 The DPA, or other similar roles that can connect the crew with onshore organisational environments that can support with implementing changes.

## 2 Application

**2.1** These guidelines are intended to apply to new and existing ro-ro ships, except existing ro-ro cargo ships.

**2.2** The REC process should be carried out in connection with ordinary fire drills, although not all of them. It can be seen as an extended fire drill that is devoted not to rehearsing existing procedures



and systems, but to identify improvement potentials for the same procedures and systems. There is no requirement with respect to the frequency of implementation, but since work practices and material environments on a ship is subject to continuous adaptation, it is recommended to implement the REC process no less than four times per year.

**2.3** The REC process is estimated to extend a regular fire drill with approximately 1 ½ hours, in addition to time necessary for planning the extended fire drill (scenario).

### **3 How to conduct the Reflection, evaluation and change process**

#### **3.1 Pre-brief**

**3.1.1** A meeting is held before the fire drill, with everybody participating in the fire drill. The intention with this meeting is to prime everybody with a ‘critical’ mindset and to reflect collectively on their existing practices and experiences, searching for improvement potentials.

**3.1.2** The pre-brief is focused on reflecting on and discussing a series of questions. The focus of the questions will change with the focus of the planned scenario. The common denominator is the heading, the context for the questions: “Based on your experience, and during the drill, try to notice...”. The framing of the pre-brief thus involves both looking back and looking forward. An example of questions that could be asked in a pre-brief when focus is on decision making and activation are provided in Textbox 1. For other foci, e.g., communication; design of instructions materials; roles and responsibilities (coordination), questions should be tailor made.

*Based on your experience, and during the drill, try to notice...*

- *Do you experience any difficulties or dilemmas?*
- *What could make this specific task difficult in a real emergency (dilemma/challenge), e.g.,*
  - *Making sense of the alarm (sensemaking)*
  - *Identifying correct drencher zone (sensemaking)*
  - *Looking up dangerous goods manifest (sensemaking)*
  - *Choice of extinguishing strategy (decision making)*
  - *Drencher activation steps (communication, know-how)*
  - *Activation instructions ‘poster’ (design)*
  - *Effect of water on dangerous goods (sensemaking)*
  - *Other ...*
- *Are there things you would have to do differently in a real fire emergency?*

Textbox 1. Leading questions for REC pre-brief. Questions may be adapted by users

The intention is to bring up experiences and knowledge that is seldom discussed explicitly, but merely coped with.

#### **3.2 REC adapted-fire drill**

After the pre-brief, the fire drill is run as planned. The crew should during the fire drill bear in mind the questions and discussions from the pre-brief. If useful, the questions could be printed and brought during the fire drill. Notes can also be taken during the fire drill, although this is often not convenient for all participants.

#### **3.3 De-brief**

**3.3.1** The debrief should start with discussing open question about learning points from the drill (Textbox 2):

- *What worked well?*
  - *How can we maintain and strengthen what went well?*
- *What did not work so well?*
  - *Is there anything we should have done differently?*
  - *If yes, which changes do that require in procedures and design?*

Textbox 2. Open questions for debrief.

**3.3.2** After the open questions session, proceed with more detailed questions (Textbox 3). The questions in this section should be related to the drill scenario and the activities undertaken during the fire drill. Hence, although many of the leading questions in Textbox 3 would be relevant in most fire drills, the questions must be adapted to the context.

*.1 Localization of fire*

- *Was it easy to make sense of the alarm?*
- *Was the information from alarm panel and other systems (e.g., CCTV) clear? What would be different in a real situation due to e.g., smoke?*
- *Was the runner sent in the right direction? How precise information was the runner able to gather?*

*.2 Dangerous goods, information and handling*

- *How was the process of looking up necessary information on dangerous goods? Easy? Cumbersome?*
- *Are there routines for checking dangerous goods when an alarm goes off? How efficient are they?*
- *Does the presence of dangerous goods cause any hesitation?*
- *Is the information about how to handle different types of dangerous goods clear and unambiguous?*
- *Do you plan so that unpleasant surprises with respect to dangerous goods cannot appear?*

*.3 Fixed water-based fire-extinguishing system activation*

- *What did you have to do to identify the correct drencher zone? Is it cumbersome?*
- *Are markings and numbering of drencher zones and pumps clear and unambiguous?*
- *Was the communication about drencher zone and pumps clear and unambiguous?*
- *Are there different locations from where drenchers could have been activated in this situation?*
- *Did you have any choice with respect to location from where you activate drenchers? (Are there organisational habits or actual/potential technical systems setup restricting the use of other locations)*
- *Was it obvious who should do the activation? Could there be alternatives regarding who undertakes the activation?*
- *Did you have any doubts at the moment of activation? Would you have any doubts if it was a real situation?*
- *Did you have the necessary information when activating the drenchers? (Both the person ordering it and the person performing the actual procedure)*
- *Are there any hands-on instructions for the drenchers? Did you make use of them?*
- *Are they well formulated? Unambiguous? Is there anything with the wording in the instruction that may lead to hesitation in a stressing situation?*
- *Are activation instructions available in all relevant locations from where activation is possible?*
- *Do the instructions say anything about who are allowed to activate the system, and in case, is it in line with the standing order or the general perception?*
- *Did the management of other fire-related equipment (e.g., fire dampers) cause any problems, delays, hesitation?*
- *How could we arrange for earlier activation the next time, or during a real fire?*

Textbox 3. Detailed questions for debrief. Note: these are only examples.

**3.3.3** A designated facilitator of the debrief session should be responsible for having the discussions and noting suggested changes, and bring this forward to the last stage.

### 3.4 Change

**3.4.1** To close the loop of the REC process, a change initiative must be implemented. The authority required to implement a design or procedural change will vary from case to case and from company to company. Some changes will be possible for the crew to implement without conference with the onshore organisation, while others may necessitate involvement from the DPA or other onshore resources. This will typically also depend on the magnitude of the change, such as the costs and time needed, whether they are small (S), medium (M) or large (L). As part of the debrief documentation, this should be described, e.g., using a table like the one in Fig. 2.

Change	Description	S M L	Responsible	Done
Technical system		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/>
Procedures		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/>
Design		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/>
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/>

Fig. 2: Description of change suggestion, magnitude and responsible.

**3.4.2** This documentation should be kept for reference until a change has been implemented. It can also be useful as a reference in case a DPA or other relevant onshore representatives wish to explore transfer value of change suggestion to other ships.

## 1.7 RCO7: Training module for efficient activation of extinguishing system

### 1.7.1 STCW Code Chap. V

The following new section A-V/5 is added after the existing section A-V/4 (Mandatory minimum requirements for the training and qualifications of masters and deck officers on ships operating in polar waters):

#### Section A-V/5

*Mandatory minimum requirements for the training and qualification of masters, officers, ratings and other personnel on ro-ro ships*

#### Standard of competence

**1** Every candidate for certification in basic training for ro-ro ships shall be required to:

**.1** demonstrate the competence to undertake the tasks, duties and responsibilities listed in column 1 of Table A-V/5-1; and

**.2** provide evidence of having achieved:

**.1** the minimum knowledge, understanding and proficiency listed in column 2 of Table A-V/5-1; and

.2 the required standard of competence in accordance with the methods for demonstrating competence and the criteria for evaluating competence tabulated in columns 3 and 4 of Table A-V/5-1.

**Table A-V/5-1**

*Specification of minimum standard of competence in basic training for ro-ro ships*

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Fight and extinguish fires	<p>Theoretical knowledge on fixed fire-extinguishing systems:</p> <ul style="list-style-type: none"> <li>.1 procedures of fixed fire-extinguishing systems activation</li> </ul> <p>Practical knowledge on fixed fire-extinguishing systems:</p> <ul style="list-style-type: none"> <li>.1 fixed water-based fire-extinguishing system activation procedure and instructions</li> <li>.2 fixed gas fire extinguishing system activation procedure and instructions</li> <li>.3 actions to be taken in case of fixed fire-extinguishing systems failure</li> </ul>	Assessment of evidence obtained from approved instruction or attendance at an approved course	Action taken on fixed fire-extinguishing system activation is appropriate to the indicated emergency and complies with established procedures

### 1.7.2 IMO Model Course “Advanced training for ro-ro operations”

A new IMO Model Course “Advanced training for ro-ro operations” is recommended to be drafted from the guidelines developed in the LASH FIRE deliverable D07.9 “Development and implementation of design guidelines and procedures for extinguishing system activation” [40]:

#### ACTIVATION OF FIXED FIRE-EXTINGUISHING SYSTEMS

**1. Target group:** Crew members (deck officers and able seaman) sailing on board ro-ro ships.

**2. Goal of the training:** Effective activation of the fixed fire-fighting systems, including both rounds of activation with both water-based system (drencher) and gas system (CO<sub>2</sub>).

#### 3. Content and agenda:

TRAINING PROGRAMME	
Training topics	hours
<b>THEORY</b>	
- Procedures for fixed fire-extinguishing systems activation (Theoretical part)	2
- End of the course. Q&A. Debriefing session	1
<b>PRACTICAL</b>	
- Drencher fire-extinguishing system activation procedure and instructions	1
- CO <sub>2</sub> fire-extinguishing system activation procedure and instructions	1
- Actions to be taken in case of fixed fire-extinguishing system failure	2
<b>TOTAL</b>	<b>7</b>
<b>SCHEDULE</b>	
08:00-08:10	Safety introduction, introduction of course and participants
08:10-08:15	Background – rationale and objective of the course
08:15-08:45	Fixed fire-extinguishing systems – some challenges and historic events
08:45-09:00	<i>Coffee break</i>
09:00-09:30	Discussions in groups and plenum
09:30-10:00	Reflective practice and learning: introduction to the learning framework of Schön
10:00-10:15	<i>Coffee break. Donning of PPE</i>
10:15-11:15	Drencher fire-extinguishing system activation procedure and instructions
11:15-12:15	CO <sub>2</sub> fire-extinguishing system activation procedure and instructions
12:15-13:00	<i>Lunch on fireground</i>
13:00-15:00	Actions to be taken in case of fixed fire-extinguishing system failure
15:00-16:00	End of the course. Q&A. Debriefing session

#### 4. Learning objective

At the end of the exercise, each trainee team should be able to efficiently activate the fixed fire-extinguishing system (drencher or CO<sub>2</sub>) on board.

#### 5. Safety briefing

Safety briefing by chief trainer of the dos and don'ts during the practical task demonstration. Correct use of PPE.

#### 6. Sequence/script for both drencher and CO<sub>2</sub> system

- 6 hands-on trainees on the training ground (i.e., container)
- 2 OOW/Master trainees on emergency simulator. They will be communicated with trainees on the training ground by means of UHF radio. Use of CCTV system
- Ensure that the system has electrical connection.
- A car will be placed inside the container with a fire inside the cabin.
- DG Magnesium (Mg). CLASS 4.3 IMDG "*Substances which, in contact with water, emit flammable gases*" will be placed inside the vehicle. No information in the cargo manifest
- Forced ventilation should be stopped.
- Head counter
- Check section/zone affected for CO<sub>2</sub>.
- Activation of fire pump (water pressure)
- Selection of valves
- Trigger fixed fire-extinguishing system.
- Confirmation with OOW/Master
- Monitoring temperature
- Has system been effective? If not consider manual firefighting. NOTE: it will be considered that drencher will be not effective due to presence of DG

#### 7. Assessment

Discusses the below listed checks of the Fixed fire-extinguishing system.

	<b>PRACTICAL TASK - ASSESSMENT</b>	<b>PERFORMED</b>	<b>NOT PERFORMED</b>
1	Trainee has received the confirmation/presence of a fire		
2	Trainee has checked that first response has not been successful or possible		
3	Presence of personnel in the area. Head count		
4	Trainee confirms the areas where the system has to be discharged		
5	Controls and distribution valves are checked before discharge		
6	Warning alarms (audible/visual)		
7	Forced ventilation is stopped		
8	All doors and openings are locked		
9	Identification of DGs		
10	Release the system		
11	Confirmation that the system has been triggered		
12	Temperature check		
13	Confirmation that the system has been effective		



## 8. Debriefing

The trainer then debriefs the trainee on the discussed checks made by the trainee (positives and negatives).

### 1.8 RCO8: Safe electrical connection for reefers

#### 1.8.1 SOLAS Ch. II-1 Reg. 45

*The following new paragraph 6.3 is added after the existing paragraph 6.2:*

**6.3** [In cargo spaces where stowage of reefer container unit, reefer trailer or electrical vehicle is foreseen] [In ro-ro or vehicles spaces of passenger ships], a separate final circuit is to be provided for each socket outlet, which is to be provided with a circuit breaker capable of being controlled from the continuously manned central control station. The insulation level, temperature, power consumption and individual phase voltage shall be monitored and recorded and any anomaly on these values shall trigger an alarm at the continuously manned central control station.

### 1.9 RCO9: Safe electrical connection of reefers and electric vehicles (EVs)

#### 1.9.1 SOLAS Ch. II-1 Reg. 45

*Add the following sentence at the end of the paragraph 6.3 proposed above:*

Where charging of electric vehicle is foreseen, the insulation level, temperature, power consumption and individual phase voltage shall be monitored and recorded both upstream and downstream the charging station.

### 1.10 RCO10: Fire detection on weather decks

No proposal for regulation.

### 1.11 RCO11: Alternative fire detection in closed and open ro-ro spaces

#### 1.11.1 FSS Code Ch. 9

*This amendment proposal is based on FSS Code Ch 9 as planned to be amended as per SSE 9/20 Annex 6.*

*The existing paragraph 2.4.2.2 is amended, as follows, and paragraphs 2.4.3.3 and 2.4.3.4 are added after the existing paragraph 2.4.3.2:*

**2.4.2.2.2** Sensor cables of the linear heat detection system shall be so installed as to pass through any zone delimited by longitudinal and transversal stiffeners below the deckhead. ~~Distance between two sensor cables of the linear heat detection system shall not be more than 9.0 m, while distance between such cables and bulkheads shall not be more than 4.5 m.~~

[...]

**2.4.3.3** Sensor cables of the linear heat detection system shall not interfere with the operation of hoistable decks or ramps.

**2.4.3.4** Sensor cables of the linear heat detection system shall be fixed at regular intervals in line with Table 9.2. In addition, when cables are not laid on top of horizontal cable trays or supports, metallic cable clips or saddles shall be provided at regular distances not exceeding 2.0 m.

**Table 9.2 – Spacing of fixing points for cables not carried in pipes**

External diameter of cables		Non-armoured or unbraided cables	Armoured or braided cables
Exceeding	Not exceeding		

[mm]	[mm]	[mm]	[mm]
-	8	200	250
8	13	250	300
13	20	300	350
20	30	350	400
30	-	400	450

## 1.12 RCO12: Visual system for fire confirmation and localization

### 1.12.1 SOLAS Ch. II-2 Reg. 20.4.4

*This amendment proposal is based on SOLAS Ch. II-2 as planned to be amended as per SSE 9/20 Annex 5.*

*The existing section 4.4 is amended, as follows – note: application dates to be agreed by IMO Member States:*

#### 4.4 Video monitoring

The requirements of paragraphs 4.4.1 and 4.4.2 apply to ships constructed on or after 1 January 2026. Passenger ships with vehicle, special category or ro-ro spaces constructed before 1 January 2026 shall comply with the requirements of paragraphs 4.4.1 and 4.4.2 not later than the first survey after 1 January 2028.

**4.4.1** For passenger ships, an effective video monitoring system shall be arranged in vehicle, special category and ro-ro spaces and in areas on the weather deck intended for the carriage of vehicles for continuous monitoring of these spaces. The system may use regular video cameras together with video analytics or thermal imaging. The system shall be provided with immediate playback capability to allow for quick identification of fire location, as far as practicable. Cameras shall be installed to cover the whole space, high enough to see over cargo and vehicles after loading.

**4.4.2** The videos recorded by this monitoring system shall be available for replay at a continuously manned control station or at the safety centre for at least seven days for installation on ro-ro passenger ships constructed on or after 1 January 2026 and 24 hours for existing ro-ro passenger ships constructed before 1 January 2026 and the correspondence between any one video camera and the section of the fixed water-based fire-extinguishing system it is covering shall be clearly displayed close to the video monitor. Continuous monitoring of the video image by the crew is not required.

## 1.13 RCO13: First response dry-pipe sprinkler system for vehicle carriers

No proposal for regulation.

## 1.14 RCO14: Fixed remote-controlled fire monitors using water for weather decks

### 1.14.1 SOLAS Ch. II-2 Reg. 20.6

*This amendment proposal is based on SOLAS Ch. II-2 as planned to be amended as per SSE9/20 Annex 5.*

*The existing paragraphs 6.1, 6.2.1 and 6.2.2 are amended, as follows – note: application dates to be agreed by IMO Member States:*

#### 6.1 Fixed fire-extinguishing systems

(The requirements of paragraphs 6.1.1 and 6.1.2 shall apply to ships constructed on or after 1 July 2014. Ships constructed before 1 July 2014 shall comply with the previously applicable requirements of paragraphs 6.1.1 and 6.1.2. The requirements of paragraph 6.2 shall apply to ro-ro **passenger** ships constructed on or after 1 January 2026. Passenger ships with vehicle, special category or ro-ro spaces constructed before 1 January 2026 shall comply with the requirements of paragraph 6.2.3 not later than the first survey after 1 January 2028.)

## **6.2 Fixed water-based fire-extinguishing on weather decks intended for carriage of vehicles**

**6.2.1** ~~In passenger ships, a~~ fixed water-based fire-extinguishing system based on monitor(s) shall be installed in order to cover weather decks intended for the carriage of vehicles. The monitor(s) shall comply with the provisions of the Fire Safety Systems Code.

**6.2.2** ~~In passenger ships, d~~Drainage shall be provided where a fixed water-based fire-extinguishing system is installed to cover weather decks intended for carriage of vehicles. The system shall be sized to remove no less than 125% of the combined capacity of both the monitor(s) and the required number of fire hose nozzles.

### 1.15 RCO15: Fixed autonomous fire monitors using water for weather decks

#### 1.15.1 SOLAS Ch. II-2 Reg. 20.6

*This amendment proposal is based on SOLAS Ch. II-2 as planned to be amended as per SSE 9/20 Annex 5.*

*The existing paragraphs 6.1, 6.2.1, 6.2.2 and 6.2.3 are amended, as follows – note: application dates to be agreed by IMO Member States:*

## **6.1 Fixed fire-extinguishing systems**

(The requirements of paragraphs 6.1.1 and 6.1.2 shall apply to ships constructed on or after 1 July 2014. Ships constructed before 1 July 2014 shall comply with the previously applicable requirements of paragraphs 6.1.1 and 6.1.2. The requirements of paragraph 6.2 shall apply to ro-ro **passenger** ships constructed on or after 1 January 2026. Passenger ships with vehicle, special category or ro-ro spaces constructed before 1 January 2026 shall comply with the requirements of paragraph 6.2.3 not later than the first survey after 1 January 2028.)

## **6.2 Fixed water-based fire-extinguishing on weather decks intended for carriage of vehicles.**

**6.2.1** ~~In passenger ships, a~~ fixed water-based fire-extinguishing system based on monitor(s) shall be installed in order to cover weather decks intended for the carriage of vehicles. **The system shall have both automatic and manual release capabilities.** The monitor(s) shall comply with the provisions of the Fire Safety Systems Code.

**6.2.2** ~~In passenger ships, d~~Drainage shall be provided where a fixed water-based fire-extinguishing system is installed to cover weather decks intended for carriage of vehicles. The system shall be sized to remove no less than 125% of the combined capacity of both the monitor(s) and the required number of fire hose nozzles.

**6.2.3** For passenger ships built before 1 January 2026, a fixed water-based fire-extinguishing system based on monitor(s) shall be installed in order to protect areas on weather decks intended for the carriage of vehicles. Monitors shall be located in positions which ensure unobstructed protection of vehicles in the area on the weather deck intended for carriage for vehicles, as far as practicable. **Monitors shall be capable of automatic activation upon detection by two separate fire detectors and**

the operation mode of the fire monitors shall be adapted to the number of fires detected. Operation of monitors shall be ensured by safe access ways or remote control not to be impaired by a fire in the area protected by that monitor. Capacity of each monitor shall be at least 1,250 L/min. The Administration may permit lower flow rates when the required rate is not practical given the size and arrangement of the ship. The Administration may also permit alternative arrangements for ships that have already installed a fixed water-based fire-extinguishing system based on monitor(s) prior to 1 January 2026.

#### 1.15.2 FSS Code Ch. 7

*This amendment proposal is based on FSS Code Ch. 7 as planned to be amended as per SSE 9/20 Annex 6.*

*The existing paragraph 2.5 is amended, as follows, and the new paragraph 2.5.7 and the new section 2.5.8 are added after the existing section 2.5.6 – note: application dates to be agreed by IMO Member States:*

### **2.5 Fixed water-based fire-extinguishing on ro-ro passenger ships' weather decks intended for the carriage of vehicles.**

This chapter details the specification of fixed water-based fire-extinguishing on ro-ro passenger ships having weather decks intended for the carriage of vehicles as required by chapter II-2 of the convention. The requirements of this chapter shall apply to ro-ro passenger ships constructed on or after 1 January 2026.

*Add the following paragraphs 2.5.7 – Fixed fire detection and fire alarm system and 2.5.8 – Automatic activation.*

**2.5.7** The fixed fire detection and fire alarm system shall be capable of identifying the position of the fire.

#### **2.5.8 – Automatic activation**

**2.5.8.1** The monitors shall be automatically activated upon fire detection by two independent fire detectors. The delay between fire detection and water discharge shall not exceed 60 seconds.

**2.5.8.2** At least two fire monitor systems shall be operable simultaneously and be capable of operating independently of each other. The systems should be positioned on opposing sides of the weather deck (either 90° or 180° of each other).

**2.5.8.3** The system shall be capable of operating regardless of the number of fires detected. The system shall be capable of managing at least four fires detected simultaneously. In the event of more than four simultaneous fires detected on the weather deck, the fire monitor system shall be programmed so as to effectively spray the entire protected part of the weather deck in an oscillating pattern.

**2.5.8.4** Once the fixed fire detection and fire alarm system stops detecting fire, the monitors shall keep oscillating the area for at least five minutes before automatically shutting off the flow.

**2.5.8.5** It shall be possible to manually stop the monitors at any time. The system shall remain ready to automatically reactivate upon fire detection at all times.

**2.5.8.6** A warning notice shall be displayed outside each entry point to the weather deck stating the type of medium used and the possibility of automatic release.

#### 1.16 RCO16: Improved knowledge in fire ventilation for closed ro-ro spaces

No proposal for regulation.

#### 1.17 Pre5: Proposal for requirements of surface materials in ro-ro spaces, with reference to suitable test method and material property performance criteria

##### 1.17.1 SOLAS Ch. II-2 Reg. 20

*The following new chapter is added to the existing chapter 3 in SOLAS II-2, regulation 20 – note: application dates to be agreed by IMO Member States.*

#### **4 Fire growth, smoke generation and toxicity**

**4.1 Surfaces of boundary bulkheads and decks of vehicle spaces, ro-ro spaces and special category spaces shall have low flame-spread characteristics in accordance with the Fire Test Procedures Code.**

**4.2 Surfaces of boundary bulkheads and decks of vehicle spaces, ro-ro spaces and special category spaces in ro-ro passenger ships shall be of approved materials which will not give rise to smoke or toxic or explosive hazards at elevated temperatures, this being determined in accordance with the Fire Test Procedures Code.**

*Furthermore, the results of the tests according to the FTP Code Part 2 - Smoke and toxicity and Part 5 – Surface flammability can support the revision of IMO Circular MSC.1/Circ.1574 Interim guidelines for use of fibre reinforced plastic (FRP) elements within ship structures: Fire safety issues. These results are documented in annexes B and C of deliverable D08.14 “Fire risk assessment and establishment of requirements [material property performance and test method for evaluation] for combustible surfaces in ro-ro spaces” [41].*

#### 1.18 Ext5: Development of a relevant fire test standard for alternative fixed water-based fire-fighting systems intended for ro-ro spaces and special category spaces

##### 1.18.1 MSC.1/Circ.1430

The revision of the fire test procedures in the Appendix of IMO Circular MSC.1/Circ.1430/Rev.2 is documented in deliverable D10.5 “Updated test standard for alternative fixed fire-fighting systems” [42] available at [www.lashfire.eu](http://www.lashfire.eu).

#### 1.19 Cont9: Ship manoeuvring/operation to limit the effect of fire at least in critical areas.

##### 1.19.1 New MSC.1/Circ.XXXX: Guidelines for ship manoeuvring in case of fire in ro-ro spaces.

*Add the following Annex to MSC.1/Circ.XXXX:*

#### **ANNEX**

#### **GUIDELINES FOR SHIP MANOEUVRING IN CASE OF FIRE IN RO-RO SPACES**

##### **1 Purpose**

The purpose of these guidelines is to provide general ship manoeuvring recommendations in case of fire in ro-ro spaces, in order to avoid smoke spread to critical areas of the ships, such as assembly stations, life-saving appliances (LSA) stowage areas or embarkation routes on open deck, and enhance safe evacuation of the ship.

##### **2 Application**

These guidelines are intended to apply to ro-ro ships.

### 3 Prerequisites

**3.1** Safety of navigation shall always be the priority (i.e., to avoid collision, grounding, contact, etc.) in comparison to ship manoeuvring in case of fire.

**3.2** The guidelines for ship manoeuvring in case of fire can be used only if the following conditions are satisfied:

- .1 the ship is manoeuvrable, i.e., no blackout;
- .2 the change of the ship's course does not endanger safe evacuation in rough seas; and
- .3 wind speed and direction are favourable to support the desired outcome after manoeuvring. Very low-speed wind will not be efficient in pushing the smoke away.

### 4. Manoeuvring recommendations in case of a fire near side openings of ro-ro spaces

**4.1** Identify the side of the ship (port side or starboard side) from where evacuation can be done and take measures to ventilate smoke away from the critical areas on that side. It is recommended to select the side of the ship that is located furthest away from the fire.

**4.2** Try to manoeuvre the ship to such direction that the critical areas on the selected side has the least impact from fire products (smoke, radiant heat flux etc.).

**4.2.1** The least impact can be achieved in most situations if the selected side is manoeuvred to face the wind perpendicular to it (portside wind or starboard side wind).

**4.2.2** If manoeuvring the ship as mentioned above is not possible, then the following recommendations need to be explored for choosing a suitable direction for apparent wind:

- .1 if the fire is located aft from the critical areas, then the suitable apparent wind is most likely headwind; or
- .2 if the fire is located forward from the critical areas, then the suitable apparent wind is most likely tailwind.

**4.3** Note that there can be smoke or stray smoke in the critical areas even after manoeuvring as per recommendations. However, its impact would be less than the other side of the ship nearest to the fire.

### 5. Manoeuvring recommendations in case of a fire near an end opening of ro-ro space

**5.1** After a fire has been confirmed onboard, assess if any smoke can be observed outside. If yes, locate the opening(s) where the smoke is coming from.

**5.2** If necessary, ventilate the smoke away from any critical areas such as assembly stations, LSA stowage areas and embarkation routes on open deck by manoeuvring the ship if possible.

**5.3** Recommendations for choosing a suitable direction for apparent wind:

- .1 if the end opening of ro-ro space producing the smoke is located aft from the critical areas to be protected, suitable apparent wind is most likely from headwind to sidewind.
- .2 if the end opening of ro-ro space producing the smoke is located forward from the critical areas to be protected, suitable apparent wind is most likely from tailwind to sidewind; and

**3** the best wind direction will push the smoke directly away from the ship, and the smoke will not travel across any parts of the ship.

**5.4** Note that having a strong sidewind can cause the smoke recirculation back to the ship on the leeward side due to pressure differences.

**5.5** Note that if the end opening is protected from the wind by large structures such as casing, smoke ventilation will not be as effective.

**5.6** It is recommended to prioritize protecting those critical areas which are located furthest away from the fire. Those which are closest to the fire will more likely become unavailable due to the heat from the fire.

**6.** It is recommended that every ship develop ship-specific drawing including location of openings in ro-ro spaces, critical areas (assembly stations, LSA stowage areas or embarkation routes on open deck, as minimum) and ship heading.

#### 1.19.2 STCW Code Ch. II

*The existing Table A-II/1 and Table A-II/2 to be amended, as follows:*

**Table A-II/1**

*Specification of minimum standard of competence for officers in charge of a navigational watch on ships of 500 gross tonnage or more*

**Function: Navigation at the operational level**

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
[...]	[...]	[...]	[...]
<p>Manoeuvre the ship</p>	<p><i>Ship manoeuvring and handling</i></p> <p>Knowledge of:</p> <p>.1 the effects of deadweight, draught, trim, speed and under-keel clearance on turning circles and stopping distances.</p> <p>.2 the effects of wind and current on ship handling</p> <p>.3 manoeuvres and procedures in case of fire in ro-ro spaces and under various conditions of wind for avoiding smoke spread to critical areas.</p> <p>.4 manoeuvres and procedures for the rescue of person overboard</p> <p>.5 squat, shallow-water and similar effects</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <p>.1 approved in-service experience.</p> <p>.2 approved training ship experience</p> <p>.3 approved simulator training, where appropriate</p> <p>.4 approved training on a manned scale ship model, where appropriate</p>	<p>Safe operating limits of ship propulsion, steering and power systems are not exceeded in normal manoeuvres</p> <p>Adjustments made to the ship's course and speed to maintain safety of navigation</p>



Column 1	Column 2	Column 3	Column 4
<b>Competence</b>	<b>Knowledge, understanding and proficiency</b>	<b>Methods for demonstrating competence</b>	<b>Criteria for evaluating competence</b>
	.56 proper procedures for anchoring and mooring		
[...]	[...]	[...]	[...]

**Tab A-II/2**

*Specification of minimum standard of competence for masters and chief mates on ships of 500 gross tonnage or more*

**Function: Navigation at the management level**

Column 1	Column 2	Column 3	Column 4
<b>Competence</b>	<b>Knowledge, understanding and proficiency</b>	<b>Methods for demonstrating competence</b>	<b>Criteria for evaluation competence</b>
[...]	[...]	[...]	[...]
Manoeuvre and handle a ship in all conditions	<p>Manoeuvring and handling a ship in all conditions, including:</p> <p>.1 manoeuvres when approaching pilot stations and embarking or disembarking pilots, with due regard to weather, tide, headreach and stopping distances.</p> <p>.2 handling ship in rivers, estuaries and restricted waters, having regard to the effects of current, wind and restricted water on helm response.</p> <p>.3 application of constant-rate- of-turn techniques.</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <p>.1 approved in-service experience.</p> <p>.2 approved simulator training where appropriate</p> <p>.3 approved manned scale ship model, where appropriate</p>	<p>All decisions concerning berthing and anchoring are based on a proper assessment of the ship's manoeuvring and engine characteristics and the forces to be expected while berthed alongside or lying at anchor</p> <p>While under way, a full assessment is made of possible effects of shallow and restricted waters, ice, banks, tidal conditions, passing ships and own ship's bow and stern wave so that the ship can be safely manoeuvred under various conditions of loading and weather</p>

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluation competence
	<p>.4 manoeuvring in shallow water, including the reduction in under-keel clearance caused by squat, rolling and pitching.</p> <p>.5 interaction between passing ships and between own ship and nearby banks (canal effect)</p> <p>.6 berthing and unberthing under various conditions of wind, tide and current with and without tugs</p> <p>.7 ship and tug interaction</p> <p>.8 use of propulsion and manoeuvring systems</p> <p>.9 choice of anchorage; anchoring with one or two anchors in limited anchorages and factors involved in determining the length of anchor cable to be used.</p> <p>.10 dragging anchor; clearing fouled anchors.</p> <p>.11 dry-docking, both with and without damage</p>		

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluation competence
	<p>.12 management and handling of ships in heavy weather, including assisting a ship or aircraft in distress; towing operations; means of keeping an unmanageable ship out of trough of the sea, lessening drift and use of oil.</p> <p>.13 precautions in manoeuvring to launch rescue boats or survival craft in bad weather.</p> <p>.14 methods of taking on board survivors from rescue boats and survival craft</p> <p>.15 ability to determine the manoeuvring and propulsion characteristics of common types of ships, with special reference to stopping distances and turning circles at various draughts and speeds.</p> <p>.16 importance of navigating at reduced speed to avoid damage caused by own ship's bow wave and stern wave.</p> <p>.17 practical measures to be taken when navigating in or near ice or in conditions of ice accumulation on board.</p>		

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluation competence
	<p>.18 use of, and manoeuvring in and near, traffic separation schemes and in vessel traffic service (VTS) areas</p> <p>.19 manoeuvring during fire in ro-ro space and under various conditions of wind for avoiding smoke spread to critical areas</p>		
[...]	[...]	[...]	[...]

## 1.20 Cont10: Safety distances between side and end openings and critical areas

No proposal for regulation.

## 1.21 Cont11: Guidance on calculation of side openings in ro-ro spaces

### 1.21.1 SOLAS Ch. II-2 Reg. 3

*Add the following in SOLAS II-2/35:*

*The existing paragraphs 3.35, 3.36 and 3.50 are amended, as follows:*

**35** *Open ro-ro spaces* are those ro-ro spaces that are either open at both ends or have an opening at one end, and are provided with adequate natural ventilation effective over their entire length through permanent openings distributed in the side plating or deckhead or from above, having a total area of at least 10% of the total area of the space sides\*\*.

[...]

**36** *Open vehicle spaces* are those vehicle spaces either open at both ends, or have an opening at one end and are provided with adequate natural ventilation effective over their entire length through permanent openings distributed in the side plating or deckhead or from above, having a total area of at least 10% of the total area of the space sides\*\*.

[...]

**50** *Weather deck* is a deck which is completely exposed to the weather from above and from at least two sides or ends.

[...]

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[...]

\*\*Space sides refer to the port and starboard side platings of the space.

### ANNEX: Interdependency matrix

The risk reduction provided by each RCO was estimated with the assumption that none of the other RCOs were implemented (i.e., each RCO was assessed independently). However, the risk reduction attributed to the implementation of a second RCO (in addition to the first one) may be reduced compared to if the second RCO was implemented on its own, especially if both are affecting the same hazards. This will lead to reduced cost-effectiveness of the second RCO, when considered together with the first one.

Where several RCOs are proposed to be implemented at the same time, the risk reduction effectiveness of such a combination should be assessed. For RCOs with strong dependency, a quantitative assessment of the combined effects should be conducted, while combinations of RCOs with weak dependencies could be quantitatively or qualitatively assessed.

A qualitative evaluation of interdependencies between all RCOs was performed, looking at the functional and computational dependencies of RCOs and respective impacts in the fire risk model. The results of this evaluation are presented in an interdependency matrix in Table 1.

The interdependency matrix lists the RCOs both vertically and horizontally. Reading horizontally, the table indicates in the first row any dependencies between RCO1 and each of the other proposed RCOs. For example, in this case the table states that if RCO1 is implemented first, RCO3, being strongly dependent on RCO1, needs to be re-evaluated before adopting it in conjunction with RCO1. On the other hand, RCO10 is not dependent on RCO1, and therefore the cost-effectiveness of RCO10 will not be affected by the combined adoption with RCO1. Furthermore, RCO2 is weakly dependent on RCO1, so a re-evaluation may or may not be necessary before a combined adoption of the two RCOs.

Table 1. Interdependency matrix.

		Secondly implemented → Firstly implemented ↓		RCO1	RCO2	RCO3	RCO4	RCO5	RCO6	RCO7	RCO8	RCO9	RCO10	RCO11	RCO12	RCO13	RCO14	RCO15	RCO16
RCO1	Improved fire patrol. Improved fire confirmation & localization <sup>1</sup>				Weak	Strong	No	No	Weak	No	Weak	Weak	No	No	Weak	No	No	No	No
RCO2	Improved signage and markings for effective wayfinding and localization	Strong		Strong		No	Weak	Strong	No	No	No	No	No	No	Weak	No	No	No	Weak
RCO3	Developed efficient first response	Weak	Weak		Strong	Weak	Weak	No	No	No	No	No	No	Strong	Weak	No	No	No	No
RCO4	Developed manual firefighting for Alternatively Powered Vehicles	No	No	Weak		No	Weak	Weak	No	No	No	No	No	No	No	No	No	No	Weak
RCO5	Alarm system interface prototype	Weak	Weak	No	No		Strong	No	No	No	Strong	Strong	Strong	No	No	No	Weak <sup>2</sup>	Weak	
RCO6	Process for development of procedures and design for efficient activation of extinguishing system	No	Weak	No	Weak	No		Strong	No	No	No	No	No	No	No	No	No	No	No
RCO7	Training module for efficient activation of extinguishing system	No	Weak	No	Weak	No	Strong		No	No	No	No	No	No	No	No	No	No	No
RCO8	Safe electrical connection for reefers <sup>1</sup>	Weak	No	No	No	No	No	No	No			No	No	No		No	No	No	No
RCO9	Safe electrical connection of reefers and electric vehicles (EVs) <sup>1</sup>	Weak	No	No	No	No	No	No	No			No	No	No		No	No	No	No
RCO10	Fire detection on weather decks	Strong <sup>2</sup>	No	Weak <sup>2</sup>	No	Weak <sup>2</sup>	No	No	No	No	No	No		No	Strong <sup>2</sup>		Weak	Strong	No
RCO11	Alternative fire detection in closed ro-ro spaces & open ro-ro spaces	Weak	Weak	Weak	No	Weak	Weak	No	No	No	No	No		No	No	No	No	No	No
RCO12	Visual system for fire confirmation and localization	Strong	Strong	Weak	No	Weak	Weak	No	No	No	No	Strong	No		No	Weak	Weak	No	No
RCO13	Dry-pipe sprinkler system for vehicle carriers	Strong	No	Strong	Strong	No	Strong	Strong				No	Strong						
RCO14	Fixed remotely-controlled fire monitor system using water for weather decks	No	No	Weak <sup>2</sup>	Weak <sup>2</sup>	No	Strong <sup>2</sup>	Strong <sup>2</sup>	No	No	No	No	No	No	No				No
RCO15	Fixed autonomous fire monitor system using water for weather decks	Strong <sup>2</sup>	No	Strong <sup>2</sup>	Strong <sup>2</sup>	Weak <sup>2</sup>	No	No	No	No	No	Strong	No	Strong <sup>2</sup>					No
RCO16	Guideline for fire ventilation in closed ro-ro space	No	Weak	No	Weak	Weak	No	No	No	No	No	No	No	No		No	No		

Notes:

<sup>1</sup> RCO1, RCO8 and RCO9 impact directly the fire ignition (i.e., preventive RCOs). If implemented first, the cost-effectiveness of the other RCOs (i.e., mitigating RCOs) shall be re-assessed.

<sup>2</sup> "Weak" or "Strong" only for weather decks. "No" for closed and open ro-ro spaces.