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COVER NOTE

From:	Secretary-General of the European Commission, signed by Mr Jordi AYET PUIGARNAU, Director
date of receipt:	17 November 2017
To:	Mr Jeppe TRANHOLM-MIKKELSEN, Secretary-General of the Council of the European Union
Subject:	COMMISSION STAFF WORKING DOCUMENT For the Council Shipping Working party IMO - Union submission to be submitted to the 5th session of the Sub-Committee on Ship Systems and Equipment (SSE 5) of the IMO in London from 12 - 16 March 2018 concerning studies of relevance to the review of SOLAS Chapter II-2 and associated Codes to minimize the incidence and consequences of fires on ro-ro spaces and special category spaces of new and existing ro-ro passenger ships

Delegations will find attached document SWD(2017) 419 final.

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COMMISSION STAFF WORKING DOCUMENT

For the Council Shipping Working party

IMO – Union submission to be submitted to the 5th session of the Sub-Committee on Ship Systems and Equipment (SSE 5) of the IMO in London from 12 - 16 March 2018 concerning studies of relevance to the review of SOLAS Chapter II-2 and associated Codes to minimize the incidence and consequences of fires on ro-ro spaces and special category spaces of new and existing ro-ro passenger ships

COMMISSION STAFF WORKING DOCUMENT
For the Council Shipping Working party

IMO – Union Information paper to be submitted to the 5th session of the Sub-Committee on Ship Systems and Equipment (SSE 5) of the IMO in London from 12 – 16 March 2018 concerning studies of relevance to the review of SOLAS Chapter II-2 and associated Codes to minimize the incidence and consequences of fires on ro-ro spaces and special category spaces of new and existing ro-ro passenger ships

PURPOSE

The document in Annex contains a draft Union Information paper to the 5th session of the Sub-Committee on Ship Systems and Equipment (SSE 5) of the IMO concerning studies of relevance to the review of SOLAS Chapter II-2 and associated Codes to minimize the incidence and consequences of fires on ro-ro spaces and special category spaces of new and existing ro-ro passenger ships. It is hereby submitted to the appropriate technical body of the Council with a view to achieving agreement on transmission of the document to the IMO prior to the required deadline of 5 January 2018[1].

Article 6(2)(a)(i) of Directive 2009/45/EC on Safety Rules and Standards for Passenger Ships[2] makes the application of SOLAS in its up-to-date version applicable to new Class A ships. The draft submission concerns amendments to SOLAS II-2 regulation 20 (Protection of vehicle, special category and ro-ro spaces) that will have a direct impact on Class A ships and therefore the said draft Union Information paper falls under EU exclusive competence.

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[1] The submission of proposals or information papers to the IMO, on issues falling under external exclusive EU competence, are acts of external representation. Such submissions are to be made by an EU actor who can represent the Union externally under the Treaty, which for non-CFSP (Common Foreign and Security Policy) issues is the Commission or the EU Delegation in accordance with Article 17(1) TEU and Article 221 TFEU. IMO internal rules make such an arrangement absolutely possible as regards existing agenda and work programme items. This way of proceeding is in line with the General Arrangements for EU statements in multilateral organisations endorsed by COREPER on 24 October 2011.

[2] OJ L 163, 25.6.2009, p. 1.

SUB-COMMITTEE ON SHIP SYSTEMS AND EQUIPMENT
5th session
Agenda item 7

SSE 5/INF.
[...] December 2017
Original: ENGLISH

REVIEW SOLAS CHAPTER II-2 AND ASSOCIATED CODES TO MINIMIZE THE INCIDENCE AND CONSEQUENCES OF FIRES ON RO-RO SPACES AND SPECIAL CATEGORY SPACES OF NEW AND EXISTING RO-RO PASSENGER SHIPS

Information from several studies which is directly relevant to this agenda item

Submitted by the European Commission on behalf of the European Union

SUMMARY

Executive summary:	This document provides information from several studies which is directly relevant to the items identified in the approved scope of this agenda item
Strategic direction:	5.2
High-level action:	5.2.1
Output:	
Action to be taken:	Paragraph 54
Related documents:	MSC 97/22, SSE 4/19, SSE 4/INF.6, FSI 21/5, MSC 96/INF.3, SSE 2/INF.3

Introduction

1 This document is submitted in accordance with section 6.12.3 of the *Guidelines on the Organization and Method of Work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies* (MSC-MEPC.1/Circ.4/Rev.4).

2 MSC 97, as set out in paragraph 19.19 of MSC 97/22, agreed to include this output in the 2016-2017 biennial agenda of the SSE Sub-Committee and the provisional agenda for SSE 4. However, taking into account the high number of areas to be considered in the analysis, the Committee instructed SSE 4 to consider the scope and the work plan, and to advise MSC 98 accordingly.

3 As instructed by the Committee, SSE 4 produced the scope of work and work plan for this item which can be found in Annexes 13 and 14 of SSE 4/19 and which were later approved by MSC 98. In this respect Member States and international organizations were invited to submit proposals for consideration by SSE 5.

4 According to the approved work plan, SSE 5 will continue the development of the draft Interim Guidelines and establish a correspondence group, with a view to finalizing such guidelines. In order to facilitate the work of the sub-committee and subsequently of the correspondence group, this document provides information from several studies which is directly relevant to the items identified in the approved scope of this agenda item.

5 The following paragraphs follow the structure of Annex 13 of SSE 4/19 and are separated into the different tasks and studies. It should be noted that this paper only covers the points for which information was already available and therefore not all the items of Annex 13 are covered below. The study contained in the Annex to SSE 4/INF.6 will be referred to as FIRESAFE I and the studies presented in SSE 2/INF.3 and MSC 96/INF.3 will be referred to as the German Risk study and German FSA study respectively.

6 It should be further noted that the European Maritime Safety Agency (EMSA) has just initiated a second complementary study (FIRESAFE II) which is scheduled to be finalized in 2018 and will be provided to IMO as soon as it becomes available.

Causes of fire ignition in FIRESAFE I

7 This study was commissioned to investigate risk control options (RCOs) for mitigating the risk from fires on ro-ro decks. It is divided in two parts: firstly, dealing with RCOs in relation to electrical fire as ignition risk and, secondly, considering RCOs to mitigate the risk of fire extinguishing failure.

8 In terms of detailed accident statistics, the FIRESAFE I study provides a fault tree regarding the electrical ignition model (Figure 1). The model is explained in part 3.1.2 of the study and the different assumptions in the cases where less data were available are explained in 3.1.3. The following paragraphs summarise the main ideas.

9 With regards to available data, it should be noted that there is no consistency in the typology of categories of hazards and ignition sources amongst the several publications on fires on RoPax ships, and more specifically on fires on ro-ro decks. It was decided to use categories of ro-ro deck fire origin similar to the ones documented in FSI 21/5:

- Tier 1 consists of three main categories: *Ship equipment, Ship cargo* and *Other cause (t*he latter includes for example fire due to cargo shift and arson).
- The *Ship cargo* category was first divided into *Vehicle* and *Cargo unit* (tier 2), to distinguish between fires originating in vehicles used to carry cargo on board and fires originating in cargo units, such as reefer units, trailers, trucked vehicles, etc.
- Fires on vehicles were divided into the categories *Cab*, *Powertrain*, and *Other* (tier 3).
- The electrical system of a cargo unit/trailer is included in the *Cargo unit* category. This was further sub-categorized into the two categories *Reefer* and *Not reefer* (tier 3), to separate refrigerated units from other cargo.
- Each category of fire origin was further divided into *Electrical* and *Other* (tier 4) and, finally, electrical fires in vehicle powertrains and reefer cargo units were further divided into *Connected* and *Unconnected* (tier 5), to distinguish fires in vehicles and cargo units connected to the ship power supply.

10 The risk model is used to structure the statistical data in order to better assess the effects of risk control measures. To populate the model, categorizations of incidents reported in

different datasets were made. Nevertheless, after having noted that the different data sources showed very similar results and considering different factors and advantages, it was decided to use only one of them (FSI 21/5) as input to the electrical ignition source fault tree. The result is shown on Table 3.1-2, whose data was used to populate the electrical ro-ro deck fire fault tree reflected in Figure 1.

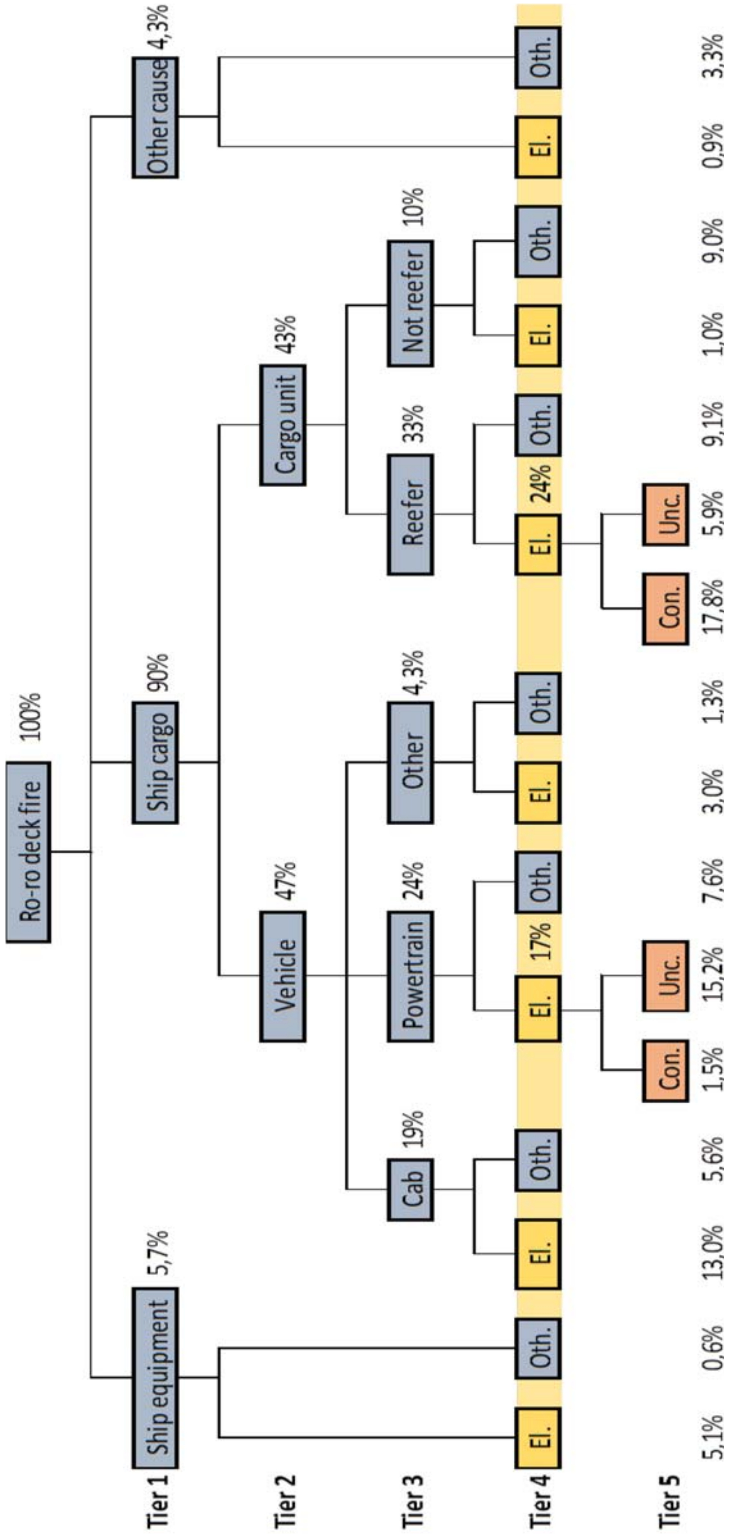


Figure 1 - Fault tree risk model for electrical fire as ignition source on ro-ro deck

11 Some of the most important findings were:

- 90% of ro-ro deck fires occur in the ship's cargo, they are therefore of an origin external to the ship;
- 33% of ro-ro deck fires originate in reefer units;
- 64% of ro-ro deck fires have some sort of electrical origin.

Causes of fire ignition in the German FSA study

12 This study was commissioned to examine whether an increase in transport operations of electrically powered vehicles (incl. fuel cell) and vehicles with refrigeration units on ro-ro and ro-pax ships would result in a higher risk of fire. As electrically powered vehicles may pose hazards which have not been identified or addressed in recent rule sets, this study aimed to identify those hazards and to assess suitable and cost efficient risk control options which may be introduced in the industry. Gas driven vehicles, except hydrogen cell vehicles, were excluded from the scope.

13 The risk analysis was carried out in a structured and systematic form on the basis of the FMECA method (Failure Modes, Effects and Criticality Analysis). Here, failure modes that can present risks to human life and the ship were identified for the considered vehicle types.

14 The considered scenarios were grouped in three clusters:

1. Electrically powered (fully electric and hybrid) and fuel cell powered vehicles not connected to the ship's power distribution system, e.g. fires involving batteries or gas leaks, respectively.
2. Electrically powered vehicles (fully electric and hybrid) as well as vehicles with a refrigeration unit (RU) connected to the ship's power distribution system.
3. Electrically and fuel cell powered vehicles are exposed to high temperatures, such as caused by a fire on board.

15 The Table 7 of the study shows a shortlist of scenarios (Appendix A contains the complete analysis of the fire safety situation) which have been addressed with suitable risk control measures, aiming to reduce the risk in terms of frequency and/or severity.

16 As outcome of the assessment, the following findings are presented:

- Risk values are high whenever the fire spreads from its original source at the electric vehicle, the refrigeration unit or power cable to other vehicles (escalation 1) and possibly to the entire loading deck (escalation 2 or "large escalation"). Here, it was assumed that the fire is no longer under control and that the ship needs to be evacuated. It was also assumed that several fatalities have to be expected in this scenario and, in accordance with a conservative assessment, also the total loss of the ship.

- Charging of the batteries of hybrid or fully electric vehicles generally increases the risk of fire and its escalation as compared to electrically powered vehicles which are not connected to the ship's power distribution system. Similarly, additional risks arise from the connection of refrigeration units to the ship's power distribution system. The supply of power to the refrigeration units or electric cars through floating cables can pose risks; specifically in the form of smouldering fires in the connector or cable (for these cases, the risk index is mainly influenced by the relatively high number of such failures and not so much by the severity of the effects).

- Vehicles with hydrogen fuel cells have a higher risk because of their fuel tank. Here, the risk for the persons on board is higher if a vehicle is affected by a fire on the deck below than in the event of a fire on the same deck. In the latter case the patrol and/or the fire-fighting team know what to expect and/or are prepared for the situation. If, however, a fire breaks out on the deck below, this may cause fuel cell-powered vehicles on the deck above to heat up, causing built-up pressure relief by means of the tank safety valve. As the hydrogen discharges unnoticed and requires very little energy to ignite, persons patrolling might be surprised by the start of a fire and/or an explosion.

17 Finally, Figure 2 summarises the results of the risk analysis in terms of additional risks to human life by transporting electric and fuel cell vehicles, as well as refrigerating units. The graphs show the risk portions for the different types of assessed vehicles. The left figure is addressing the identified risk for all addressed scenarios and the right figure extracts the risks which arise from nearby fires affecting the assessed types of vehicles.

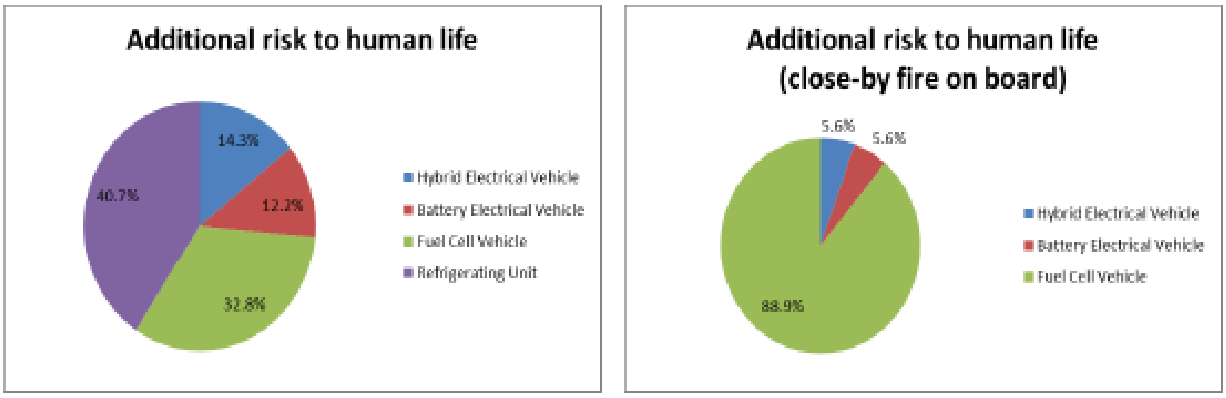


Figure 1 - Additional risk to human life by transporting electric vehicles and refrigerating units.

Electrical supply and connections to vehicles

17 It should be noted that this item is addressed by proposals in SSE 5/7/XX, where the relevant information from the studies is presented.

Risks arising from alternatively powered vehicles;

18 Within the hazard identification contained in the German FSA study, parts 4.2 & 4.3 are devoted to battery systems in electrically powered vehicles and to fuel cell vehicles, respectively.

19 Although there are two battery technologies that can be used for electric mobility, lithium ion and nickel metal hydride cells, the former play a dominant role in portable applications. In the event of an accident or overcharging, lithium ion accumulators tend to develop a self-amplifying reaction (thermal runaway). This may lead to a fire or deflagration with temperatures between 600 and 700 °C. Battery fires produce toxic gases - approx. 25 per cent by volume of carbon monoxide, but also traces of phosphine, aldehyde and hydrogen fluoride (The latter reacts with the moisture in the air to form hydrofluoric acid which is highly corrosive

and toxic). Approximately 15 per cent by volume are hydrogen which can mix with the atmospheric oxygen to form explosive oxyhydrogen. On the other hand, real fire test showed on two electric powered vehicles with lithium ion batteries that the heat release rate and the toxicity of combustion gases are comparable with vehicles with internal combustion engine.

20 So far, for fuel cell-powered passenger cars, low temperature fuel cells (LTFC) with hydrogen have been used almost exclusively. Compared to conventional vehicles, additional risks resulting from the use of fuel cell systems in vehicles may arise from the use of gaseous fuels and their storage in pressure tanks, from the use of battery systems with a comparatively higher voltage level and from the use of lithium ion batteries. The risks are, for the most part, known due to the successful use of vehicles using compressed natural gas (CNG) as fuel, the use of liquefied petroleum gas (LPG) and the use of hybrid electric vehicles. The additional risks for fuel cell-powered vehicles compared with these systems depend on the alternative fuels used: a flammable liquid (e.g. methanol) or a flammable gas (e.g. hydrogen).

21 As referred in the German Risk study, the following possible additional risks for the ship's systems, the crew and the passengers may result from fuel cell-powered vehicles:

- External leakage of hydrogen/methanol into the vehicle deck.
- Possible formation of explosive gas clouds.
- Battery system failures (fire, explosion, high voltage).

22 Due to the risk of explosions and jet fires caused by the discharge of hydrogen from fuel cell vehicles, DNV-GL considered as RCO the possibility of transporting the Fuel Cell Vehicles on a weather deck (RCO3). Due to the high radiation impact of jet fires, the stowage deck should be without any further cargo deck or accommodation deck above. The RCO was found cost-effective and, therefore, the study recommends the amendment of IMDG Code Part 3.2 to consider gas driven and fuel cell vehicles to be stored on the weather deck, so far available.

23 The study also recommends a safety assessment of the transport of gas powered vehicles on board of ro-ro and ro-pax ships (hazard consequences are seen comparable to hazards identified for fuel cell vehicles powered by hydrogen). Other recommendations refer to the need of more detailed studies of the interaction of electrically powered vehicles with dangerous goods during a fire incident within the cargo areas.

Best practice in operational procedures and training regarding prevention/ignition

24 As in paragraph 17, the results of the studies in relation to this item are covered by SSE 5/7/XX.

Fire growth mechanisms such as slow and fast growth

25 The FIRESAFE I study carried out a literature analysis to study the critical factors that influence the fire development on a ro-ro deck. The fire growth, in terms of heat release rate ($\dot{Q}$) is usually simplified as proportional to the square of time:

$$\dot{Q} = \alpha t^2$$

26 The fire growth rate (α) varies depending on the type of vehicles and/or cargo carried on-board. Accordingly, depending on that factor the fire can be classified as slow, medium, fast and ultrafast in terms of fire growth. FIRESAFE I cites several studies carried out for cars and

estimates different fire-growth rates. For cars, relevant for ro-ro decks, a medium growth rate is expected.

Fire detection, including in-vehicle fires and the effect of vehicle stowage density, wind and ventilation

27 Early detection of the fire and quick activation of the fire extinguishing means is often cited as the key to successful extinguishment. Since the detection failure and the decision time after detection were not investigated in FIRESAFE I, it was decided to merge these items under the simplified node of “early” and “late” decision.

28 “Early” and “Late” decision should be understood in relation to the fire growth rate. “Early” means that the system has been activated early enough to have a certain chance to extinguish the fire. “Late” means that the fire is already too developed, and that it is too late to have a chance to extinguish it. However, the fire can still be suppressed. Regardless of the cause of the delay in the fire-fighting actions (detection or decision process), the consequence in terms of the ability of the first response team, fire-fighting group or fixed fire extinguishing system to extinguish the fire remains the same.

29 According to FIRESAFE I and based on 28 accident reports, the probability of early decision was estimated to be 68% approximately. It should be further noted that in the case of late decision the probability of an unsuccessful suppression was estimated to be around 77%.

30 All installed fire detectors follow physical principles for the recognition of dangers and their parameters are aligned to the different fire by-products (combustion gases). In general the following applies: the fire by-product has to reach the sensor to trigger a danger signal. The study showed that the effectiveness is in some cases limited by the local settings, i.e., individual sensors or entire monitoring sections are ineffective. The reasons for this are unsuitable installation locations, e.g. sensors were installed in ceiling panels in such a way that heat barriers form underneath them preventing fire by-products form reaching them.

31 CCTV was a useful tool in several of the fires analysed, although smoke impaired the visibility rather quickly in most cases.

Detection systems for leakages from alternative fuel vehicles

32 In principle there are two battery technologies used for electrical mobility: lithium ion and nickel metal hydride (NiMH) cells. If a lithium ion battery catches fire, this can result in temperatures between 600°C and 700°C. Battery fires produce toxic gases, approximately 25% by volume of carbon monoxide but also traces of phosphine, aldehyde and hydrogen fluoride. Approximately 15 per cent by volume are hydrogen.

33 Before a battery starts burning, gases escape from the housing. Their concentration is sufficient for measurement and detection. However, such detecting sensors are currently not included on ships. The German FSA study proposes to expand the wording of the protection objectives in the SOLAS Convention, i.e., in Chapter II-2, Regulation 7 Detection and Alarm: Detection of gases, detection of smouldering fires (fires with some smoke development but no open fire) and detection of open fire with smoke development. If the gas detection system is connected to the safety monitoring and control system countermeasures like increased ventilation may be automatically activated. However, increased ventilation can be counter-

productive if the fire has already started. If manual actions are required and crew has to enter the cargo deck they will be alarmed to poisonous gases even if no flames or smoke is visible.

34 So far, for fuel cell powered passenger cars, low temperature fuel cells (LTFC) with hydrogen have been used almost exclusively. The hydrogen is stored under high pressure. If heated strongly, the pressure will increase and hydrogen might be discharged unnoticed. As hydrogen is lighter than the air, it will collect under the ceiling of the deck and might cause a severe explosion with catastrophic consequences. Escaping hydrogen cannot be detected by the sensors currently in use on ships. The German FSA study recommends amending the IMDG Code Part 3.2 to consider gas driven and fuel cell vehicles to be stowed on the weather deck only with appropriate distance to any air intakes.

35 Many of the fires caused by alternative fuels vehicles start with overheating. Potential fires could be detected and avoided if overheated equipment could be detected before the fire starts. Portable thermographic cameras have during recent years become increasingly smaller, more inexpensive and easier to use. FIRESAFE considered an RCO to use thermographic cameras for screening during fire rounds upon suspicion to detect hot areas and overheated electrical equipment. This RCO is also useful for any fire caused by an electrical failure of a reefer.

36 The possibility of marking BEV, HEV and FC vehicles while on the RoPax was also considered so that emergency services can act accordingly in case of fire. With this measure the possibility to detect a fire before it starts would improve by increasing the frequency of fire patrols where these vehicles are located. However, this option was assessed and found not cost-beneficial. Nevertheless, it was recommended to further explore the combination of the marking of vehicles with an improvement of the training to the crew on these vehicles.

37 The RCO to store electrically powered vehicles including FC vehicles in special areas with improved gas detection, far from dangerous goods vehicles and separated by means of a water wall or mobile partitions was also investigated. However, this option proved to be not cost-efficient. This RCO was rated with negative effect (risk increase). This increased risk is caused by the accumulation of vehicles with a higher ignition risk in these areas which may result in uncontrollable fire propagation. It should be noted, however, that the car fleet prediction of the study only reaches until 2020 and therefore a situation where a larger number of alternatively fuelled vehicles was not taken into consideration.

Best practice in operational procedures and training

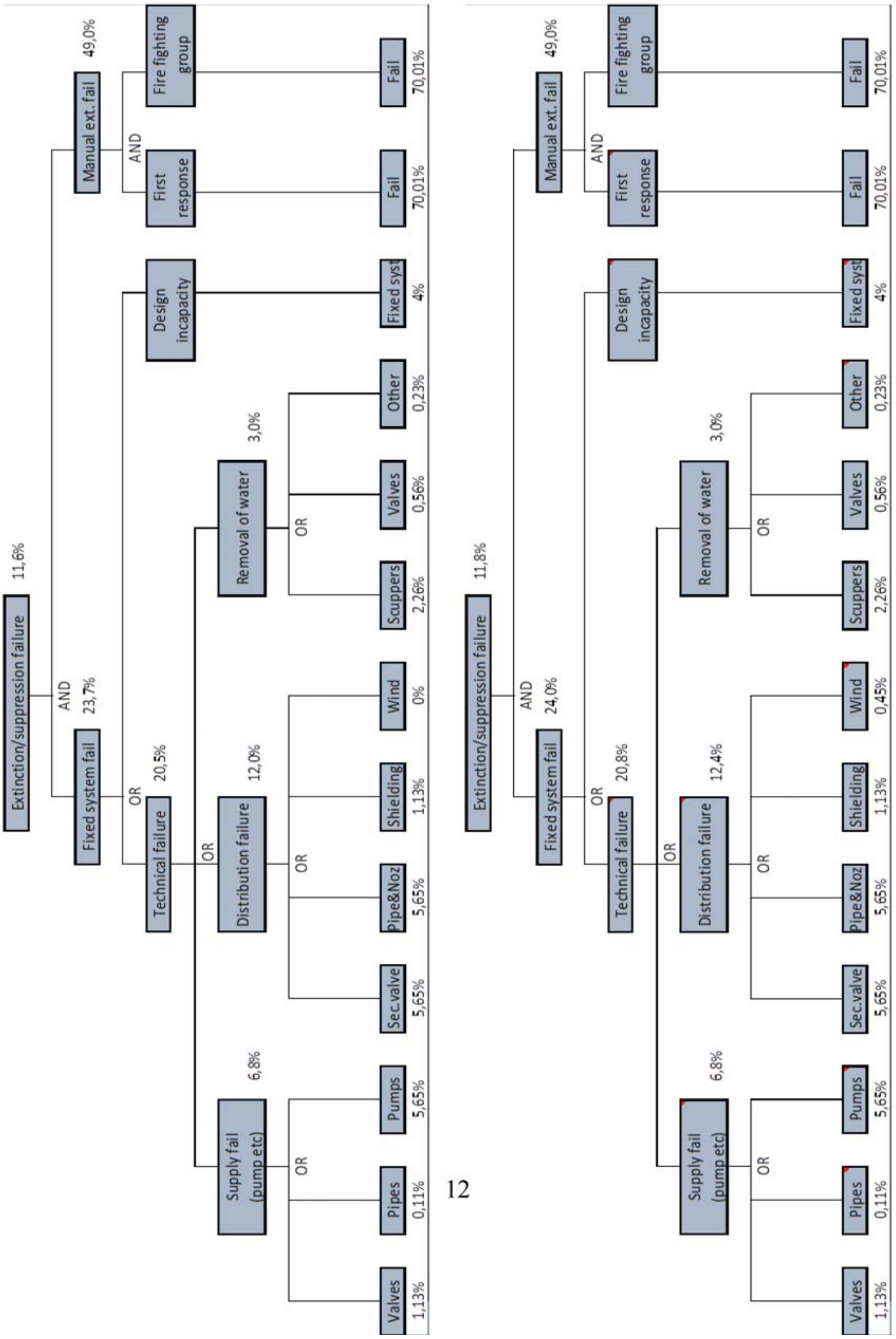
38 One of the risk control options considered in the German FSA study was the extended training on firefighting for the unique risks that battery and gas powered vehicles pose. The training should cover detection, behaviour, severity and the suppression of fire. The effectiveness is expected to be increased. The trained crew will be able to interpret early signs of pre-fire development.

Fire suppression and extinguishing systems, capabilities and reliability, and the effect of vehicle stowage density, wind and ventilation

39 It should be noted that neither FIRESAFE I nor the German studies investigated or performed tests on fire extinguishing systems as they were part of the IMPRO project. The IMPRO project led to the revision of the requirements for water based firefighting systems

(except for systems designed as alternative systems) with the development of MSC.1/Circ.1430.

40 However, following accident statistics and expert judgement, a fire extinguishing failure tree was developed in FIRESAFE I in order to quantify the contribution of each possible failure and to calculate the total fire extinguishing failure as can be seen in Figure 3. While the structure of the tree remains the same in all cases, the dependent probabilities are adapted based on different scenarios such as deck configuration and early or late decision.



41 The depicted fault trees represent the two scenarios of closed and open ro-ro deck. As can be seen there are some differences in the dependent probabilities, the most obvious being that there is no wind effect in the case of a closed ro-ro deck.

42 FIRESAFE I established different scenarios to analyse the influence of ventilation on fire growth, using a model ship. As can be seen in Figure 4, for closed ro-ro spaces, the results of the study show that if the ventilation is closed at the beginning of the ignition, the fire would be theoretically self-extinguished after 25-30 minutes reaching a peak of 30MW. In the scenario where the ventilation is not stopped, the fire would self-extinguish in about 7 hours, stabilising at a heat release rate of 60MW 40 minutes after the initial ignition. This also means that, theoretically, the containment time prescribed in SOLAS of 60 minutes would be enough to stop the fire spreading to other spaces in the scenario where ventilation is closed but not for the continuous ventilation scenario.

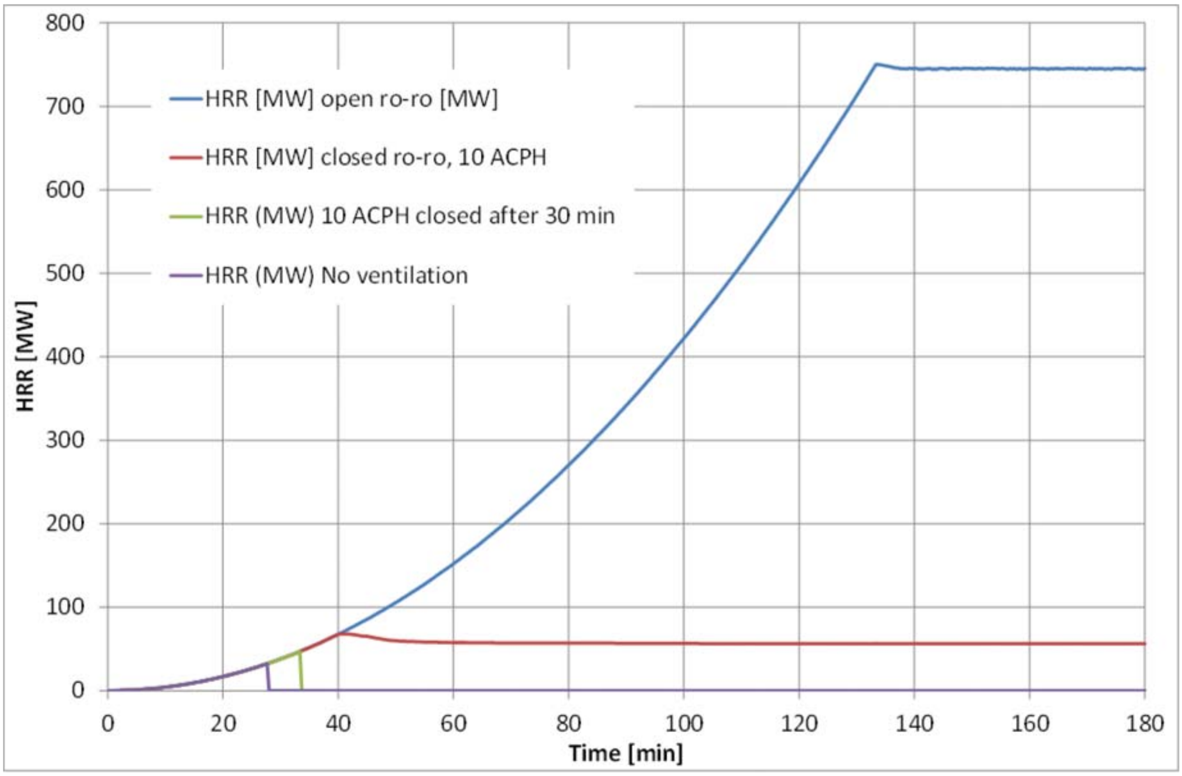


Figure 3 - Heat release rates as a function of time for varying levels of ventilation

43 In the scenario of the open deck, the fire would take almost 2 hours to self-extinguish, but it would quickly reach a peak of more than 500MW. This means that it is very likely that the fire would spread to other spaces very quickly and it is also probable that evacuation would be necessary.

Speedy activation of systems in the correct location

44 In the FIRESAFE I study this part of the risk model is covered under the early/late decision node which was analysed in paragraphs 27 and 28 above. However, some relevant RCOs were considered in the study, namely remotely controlled fixed fire extinguishing systems or a combination of such systems with CCTV. Both RCOs were found to be cost efficient for both newbuildings and existing ships.

Techniques for tackling fires involving alternatively powered vehicles

45 The German Risk study contains some useful information in relation to this issue. More specifically, it is mentioned that in the case of fires involving or near electrically and fuel cell-powered vehicles, it is especially important to cool down the material that is on fire as well as its surrounding area. This requires large quantities of water. Therefore, and in order to avoid endangering the stability of the ship with the extinguishing water, ensuring the unhindered runoff of the extinguishing water is of special importance.

46 Spaces where hydrogen can escape must not be protected by a CO2-based fire suppression system, as CO2, when being discharged, may ignite hydrogen AGBF, 2008). High pressure water mist systems seem to be particularly suitable because they disperse the fire-fighting agent very evenly throughout the room, also allowing it to reach covered areas. When applied locally, high pressure water mist has an inerting and cooling effect.

47 Mobile units have low hose diameters which, on the one hand, makes them lightweight and allows for long hose lengths. On the other hand, such hoses limit water throughput per unit time and may get stuck in narrow spots.

48 High energy fires might also be fought more successfully by adding additives to the extinguishing water. Additives are used to improve the properties of the extinguishing water. Compared with normal water, wetting agents and wetting water have a lower surface tension, and therefore the extinguishing agent can penetrate the burning material more thoroughly. Low-dose foaming agent is used as wetting agent. Aqueous Film Forming Foam (AFFF) is a synthetic foaming agent which helps to create a foam that forms a water film. AFFF is superior to water when it comes to forming an aqueous film between the burning material and the side on which the extinguishing takes place which prevents the supply of oxygen to the burning material has good cooling properties and stops additional inflammable gases from outgassing into the combustion zone.

Best practice in operational procedures and training

49 While the FIRESAFE I study did not particularly focus on operational procedures and training, two relevant RCOs were presented and found to be cost efficient, namely the “efficient activation routines” and the “fresh water activation/flushing”.

50 The efficient activation routines RCO is about improved and more efficient routines for activation of the drencher system. The idea is that a quick activation is possible (with the presently installed systems) if the crew is well educated, well trained and has a thorough understanding and knowledge about the drencher system. The understanding of possible fire development on ro-ro-spaces shall be increased.

51 This could be achieved with realistic training on the use of the fixed fire extinguishing system in order to achieve company defined goals for release times (e.g. 3 minutes from alarm

to water on deck). Drills should be performed frequently in a realistic manner, preferably simulating failure of key components.

52 Simple and clear communication procedures should be developed to e.g. decrease the risk of opening the wrong drencher section. Improved crew familiarization and training will increase the probability that the crew discovers possible faults even before a real fire starts. The possibility to handle and quickly solve unexpected problems during a fire will also increase.

53 Regarding the fresh water activation/flushing RCO it should be noted that the RCO suggests the use of fresh water (or possibly distilled water) during testing and an increase of deluge system flushing frequency (from one to two times in a five-year period). The amount of available fresh water needs to be sufficient to allow activation of the drencher system with full working pressure. It is believed that the increased flushing frequency needs to be combined with fresh water free from mud in order to achieve less clogging. It is also assumed that in a real fire sea water will be used.

Action requested of the Sub-Committee

54 The Sub-Committee is invited to consider the information provided in this document.

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