**SUMMARY OF THREE CARRIERS’ REPLIES**

**1. What can be done to improve the fire detection in a container cargo under deck?**

**Carrier One**

1. Improving crew familiarization with limitations of CH Smoke Detection units to ensure operational readiness, maintenance schedules carried out and followed up.
2. Testing of the Fire Detection Equipment to be done in a timely manner to verify efficiency of the equipment
3. Installation of temperature sensors can be considered inside the cargo holds at key locations (including bottom & mid-level) initiating an alarm if temperature is noted beyond present levels.
4. Increasing the number of sampling lines for smoke detection system (branching at each tier level inside cargo hold).
5. Dedicated smoke sampling and fire alarm system (for set of 2 to 3 cargo holds) – reducing length of smoke sampling sensing lines.
6. Installation of cameras capable of sensing change of picture or smoke due to density.
7. Installation of infrared smoke sensors arrangement inside cargo hold.
8. Improve planning system and do NOT allow self-heating substances under deck
9. install heat sensors with remote alert capability in containers with self-heating (the remote alert capability can be part of a fire extinguishing system in those specific containers).

**Carrier Two**

Enhanced cargo hold monitoring notation could be considered, alarms in case of threshold temperature violation is possible. For example DNV Enhanced fire detection notation FCS(FD) requires enhanced smoke and heat detection systems installed in all cargo holds.

**Carrier Three**

Thermal imaging cameras/flame detector sensors, can aid to detection at all levels in the hold, enabled with visual and audible alarm (Example: <https://www.flir.asia/instruments/early-fire-detection/> )

**2. What can be done to improve the fire detection in a container cargo on deck?**

 **Carrier One**

1. Installation of camera for cross deck views.
2. install heat sensors with remote alert capability in containers with self-heating (the remote alert capability can be part of a fire extinguishing system in those specific containers).

**Carrier Two**

For example FCS(FD) requires installation of camera-based on-deck heat (fire) detection system. Typical enhanced detection systems incl.:

Sample smoke extraction with reduced response time

Laser smoke detection

Thermal imaging

Optical imaging

**Carrier Three**

Thermal/flame/smoke detecting cameras on deck

**3. What can be done to enable a more precise and quick fire localisation?**

 **Carrier One**

1. Use “Smart Containers” with t° alerts / smoke detectors / NXT / TRX
2. Other actions for improving the reliability of the detection system could be addressed to the reduction of the air exchange between the CH and the open deck by means of:
* non weather tight type hatch cover on container vessels can be provided with inflatable packing between pontoons to air seal cargo hold when required;
* Installation of plates with limited openings between hatches in same cargo hold;
* Installation of plates with limited openings between Port, Stbd, Centre part of cargo hold;
* Ramnek tapes can be supplied to all vessels in quantity adequate to cover the largest single CH onboard.

**Carrier Two**

For example a notation or solution similar to Enhanced fire detection with container identification FSC (FD+)

On deck: Thermal sensors based on risk goal-based evaluation scanning entire deck space. For example thermal sensors permanently installed in high-up positions such as funnel, bridgewing, wheelhouse top.

Under deck: Thermal sensors could assist in early detection, however fixed installations are prone to damage during discharge and loading of cargo wherefore mobile equipment solutions would seem a good possibility.

**Carrier Three**

-- Sufficient water monitor capability for each bay on deck to fully cover all the stacks of that bay.

-- Fixed water sprinkler system in the cargo hold.

-- Alarm systems with thermal detections to point out exact location on the effected bay (e.g. heat detected at 53-02-12 ETC)

**4. What can be done to compensate the deficiencies of CO2 with regard to smothering a fire in a container stow under deck?**

 **Carrier One**

1. Water drenching nozzles on underside of hatch covers can be provided as an additional measure.
2. Provision of high expansion foam concentrates with fixed nozzles/concentrate containers provisions at tank top level inside cargo hold with drive water and valves located outside cargo hold
3. Use “smart fire fighting system” / “smart containers”

**Carrier Two**

A risk evaluation-based approach such as the Risk-Zone Based Dangerous Goods Stowage Concept where only Dangerous Goods that can effectively be extinguished with existing Fixed Fire Fighting CO2 solutions, are stowed under deck.

There are many cargoes that will flare up again once CO2 begins to dissipate where for only cargoes that can effectively be extinguished permanently should be placed under deck, similarly all oxidizing cargoes should be placed on deck only.

General considerations to hatch foaming effectiveness could be relevant as well as inspection program.

**Carrier Three**

High expansion foam in cargo hold has already been developed and can address this issue (Example : <https://kashiwa-tech.co.jp/en/fire-ex/fire-ex-d8/> )

**5. What can be done to improve the confinement of a fire in containers under deck to the particular cargo hold?**

 **Carrier One**

1. Have void spaces between cargo holds or fixed sprinkler nozzle rail arrangement on forward and aft bulkhead for continuous boundary cooling for cargo hold having container on fire.
2. Fitting of fire insulation (A-60 Class) on bulkheads separating CHs could be considered, where feasible.
3. The concept of fire containment can be part of the ship’s planning, by, for example:
* avoiding the stowage “en mass” of container carrying certain material (e.g. ammonium nitrate) ;
* combination planning when possible to create extra fire protection walls by selecting your cargoes;
* select cargoes that require the same fire fighting approach-attack;
* Avoid heated tanks/spaces

**Carrier Two**

A notation or solution similar to DNV Fire-fighting notation FCS(FF) could be considered. The notation requires a permanently installed cooling system to be installed in all cargo holds. The cooling system shall consist of water spray nozzles, fixed supply piping system and remotely operated stop valves. Further defined requirement that the cooling system shall be able to distribute water uniformly on the upper surfaces of all top (under deck) containers and underside surfaces and open supporting structure of the hatch covers.

The Risk-Zone Based Dangerous Goods Stowage Concept does not allow stowage of Dangerous goods adjacent to accommodation and engine room under deck structure i.e. stowage of Dangerous Goods is only possible where removed by a fire proof bulkhead, thus restricting development of under deck fire to cargo space between fire proof bulkheads away from critical areas essential to crew safety and vessel maneuverability.

**Carrier Three**

-- High expansion foam flooding as mentioned above.

-- Fixed sprinkler system

-- Water flooding of one cargo hold (prevention of progressive flooding, dewatering system, structural strength, special class notation ETC required)

**6. What can be done to improve the confinement of a fire in containers on deck to the particular bay or section thereof?**

 **Carrier One**

1. Provision for fixed water sprinkler lines/nozzles adjoining lashing bridge area facing containers.
2. Provision for fixed nozzles for water lance on all cross decks.
3. Refer to the planning stage as per 19.

**Carrier Two**

Similar to the considerations of under deck stowage of Dangerous Goods, the Risk-Zone Based Dangerous Goods Stowage Concept does not allow Dangerous Goods to be stowed next to accommodation or engine room, minimum 40’ separation is required. The 40’ gives crew an improved distancing when on-deck firefighting and improves successful fire extinguishing before breaching accommodation and engine room access. Additionally, fire-fighting equipment such as fixed or portable water monitors can provide extra water curtains between bay areas or from bridge wings enabling colling and shielding from bay at fire.

**Carrier Three**

Make water curtains by using strategically placed remote controlled water monitors to adequately separate effected bay from adjacent bays

**7. What can be done to improve active firefighting on deck bearing in mind reduced crew and local conditions?**

**Carrier One**

1. Same as per question  no. 6.
2. Use arrangements similar to HydroPen.
3. Use water monitors capable of delivering water through the deck’s length.

**Carrier Two**

Ad 6 as well. The Risk-Zone Based Dangerous Goods Stowage Concept provides distancing to the fire and increases possibility of firefighting with adequate distance and without exposure to direct hear radiation.

Additional Fire-fighting equipment such as fixed or portable water monitors can provide extra water curtains between bay areas and once installed does not need permanent manning.

**Carrier Three**

-- Remote controlled water monitors fixed at appropriate heights as mentioned above

-- Remote controlled ventilation closing arrangements for cargo holds (must be fire resistant system)

-- A plan that provides quick firefighting guideline for each bay

-- Dedicated cargo fire control station

-- Registering with shore based quick action support team specialized in container cargo fire

**8. What can be done to protect vital ship structures under deck and on deck from excessive heat?**

 **Carrier One**

1. Have guards with fixed sprinkler nozzle rail arrangement on forward and aft bulkhead inside cargo holds and on lashing bridge for continuous boundary cooling & ensuring containment within the area affected.
2. It should not be disregarded the need of pumping out of water.

**Carrier Two**

The Risk-Zone Based Dangerous Goods Stowage Concept is designed to protect hull integrity, vessel stability and vessel maneuverability. It should be considered to imbed the Risk-Zone Based Dangerous Goods Stowage Concept in SOLAS and the IMDG Code as mandatory DG Stowage.

On deck: Additional Fire-fighting equipment such as fixed or portable water monitors can provide extra water curtains between bay areas and once installed does not need permanent manning.

Underdeck: Water spray for cooling

**Carrier Three**

Heat resistant paint/steel (A-60 class ETC)

**9. What can be done to improve the protection of deck house and life-saving appliances?**

 **Carrier One**

1. Provision of fixed sea water cooling of accommodation block plating forward and aft during fire on containers (a similar provision is provided in the IGC Code). LSA must be similarly protected or ensured located not in extreme close vicinity to the bays Fwd and Aft. They must be located within safe distance of not less than 2 m from the fwd and aft bays.
2. Specific substances not to be loaded in the vicinity of the safe zone – this is mainly made via DOC for DG, but can be optimized.
3. Consider improvement of PPE (e.g. firemen outfits).

**Carrier Two**

Ad 8. As well. Detailed evaluation of life saving appliances positioning could be relevant based on the latest major fire incidents in conjunction with possible water spray system protection deck house and/or life-saving appliances.

**Carrier Three**

-- Heat resistant paint/steel(A-60 class)/ portholes.

-- positive pressure air ventilation system (with air intakes strategically positioned and powered by emergency source too) .

-- Dedicated assembly station for crew (not fighting afire ) to shelter during a firefighting adequately sheltered from deck fire with easy access to life boats

-- Water spray system for accommodation exteriors and lifeboat stations

 In addition, a focused training schedule of the crew on cargo fire can be emphasized.

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