



# SAFETY INVESTIGATION REPORT

202009/031

REPORT NO.: 21/2021

September 2021

The Merchant Shipping (Accident and Incident Safety Investigation) Regulations, 2011 prescribe that the sole objective of marine safety investigations carried out in accordance with the regulations, including analysis, conclusions, and recommendations, which either result from them or are part of the process thereof, shall be the prevention of future marine accidents and incidents through the ascertainment of causes, contributing factors and circumstances.

Moreover, it is not the purpose of marine safety investigations carried out in accordance with these regulations to apportion blame or determine civil and criminal liabilities.

### NOTE

This report is not written with litigation in mind and pursuant to Regulation 13(7) of the Merchant Shipping (Accident and Incident Safety Investigation) Regulations, 2011, shall be inadmissible in any judicial proceedings whose purpose or one of whose purposes is to attribute or apportion liability or blame, unless, under prescribed conditions, a Court determines otherwise.

The report may therefore be misleading if used for purposes other than the promulgation of safety lessons.

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## **MV X-PRESS GODAVARI** **Fire in a container,** **while anchored,** **at Sandheads Anchorage, India** **28 September 2020**

### SUMMARY

On the morning of 28 September 2020, while the vessel was anchored at Sandheads Anchorage, India, the master and the chief officer noticed a container on deck emitting smoke.

Upon confirming their suspicions, the general alarm was sounded and, soon after, boundary cooling was commenced.

Since the contents of the container were not known to the crew members, the charterers

were contacted, who later confirmed that it contained lithium-ion batteries.

Early the following day, the vessel weighed her anchor and proceeded to Kolkata Harbour, where the container was unloaded and the fire extinguished.

Considering the actions taken by the flag State Administration and the Company, no safety recommendations have been made.



## FACTUAL INFORMATION

### The vessel

*X-Press Godavari* (Figure 1) was a container vessel of 8,971 gt and 917 TEUs<sup>1</sup>, owned by BS Marine Private Limited and operated by Sea Consortium Pte. Ltd., Singapore. The vessel was built at Volharding Shipyard BV, Hoogezand, the Netherlands, in 2008 and was classed with Korean Register of Shipping (KR). The vessel had a length overall of 154.85 m and a moulded breadth of 21.50 m. The vessel's summer draft was 6.98 m, corresponding to a summer deadweight of 10,617 metric tonnes.

Propulsive power was provided by a four-stroke, medium speed, single-acting, Caterpillar MAK 8M 43C marine diesel engine, which produced 7,999 kW at 500 rpm. This drove a variable pitch propeller, enabling the vessel to reach an estimated speed of 19 knots.

At the time of the occurrence, the vessel was carrying 630 TEUs, and drew a maximum draft of 7.00 m.

### Crew

*X-Press Godavari*'s Minimum Safe Manning Certificate required a crew of 13. At the time of the occurrence, there were 15 crew members on board from Bulgaria, India, Russia, Ukraine, and the Philippines.

The master had been at sea for 27 years, four of which in the rank of a master. He held STCW<sup>2</sup> II/2 qualifications and had been sailing with Sea Consortium Pte. Ltd. for two years in this rank. He joined *X-Press Godavari* in Port Kelang, Malaysia, on 06 July 2020.

<sup>1</sup> Twenty-foot equivalent unit.

<sup>2</sup> IMO. (2010). *The Manila amendments to the annex to the International convention on standards of training, certification and watchkeeping for seafarers (STCW)*, 1978. London: Author.

The chief officer had joined *X-Press Godavari* on 17 February 2020, in Singapore. He had 28 years of sea service, 10 of which in the rank of a chief officer. He held STCW II/2 qualifications for a master on ships of 300 gt or more. The chief officer kept a watch at sea but not in port.

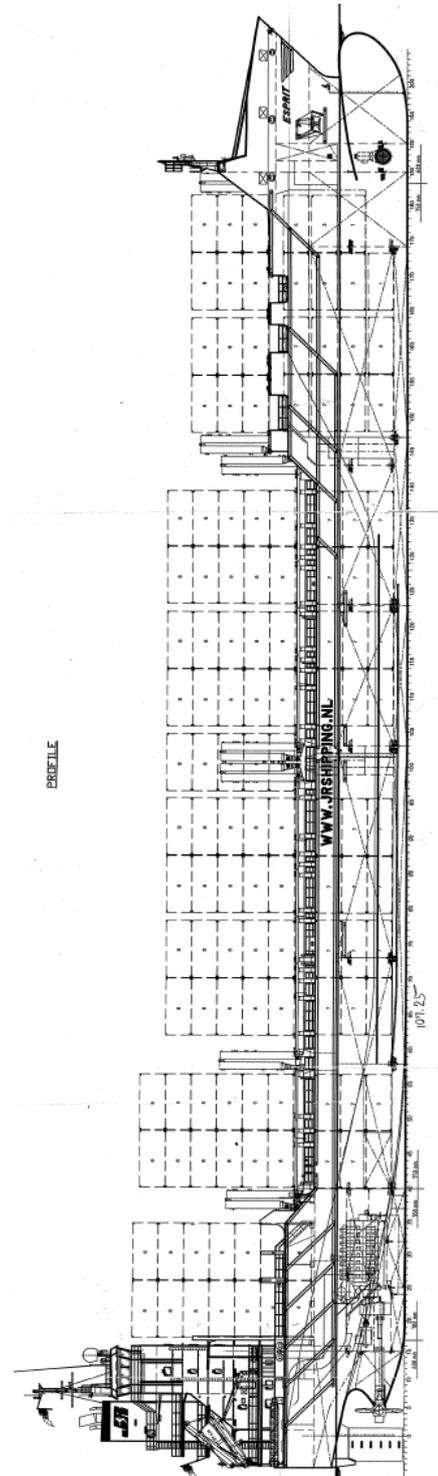


Figure 1: Extract from the vessel's GA plan

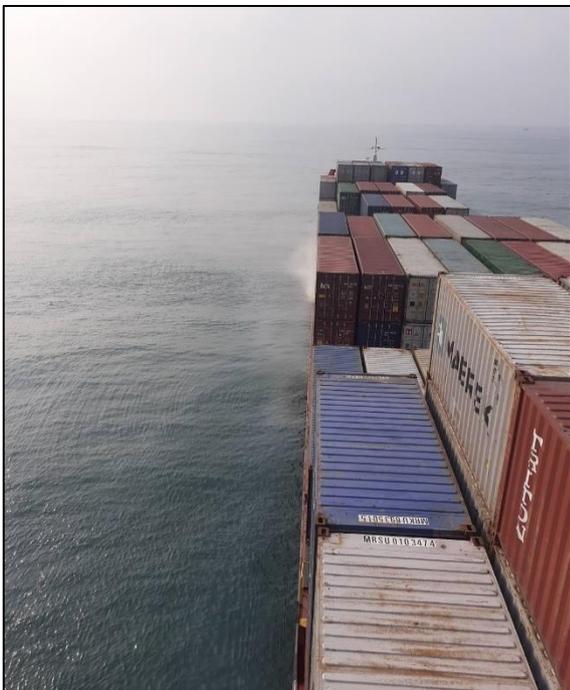
## Environment

At the time of the occurrence, the sky was reportedly clear and a visibility of six nautical miles was recorded. The sea state was calm with low swell from a Southwesterly direction. The wind was Force 3 on the Beaufort scale from the Southwest. The air and sea temperatures were 28 °C and 29 °C, respectively.

## Narrative<sup>3</sup>

The vessel had departed Port Kelang, Malaysia, on 23 September 2020. The air temperatures experienced throughout her voyage were recorded to have been in the range of 27 °C to 30 °C.

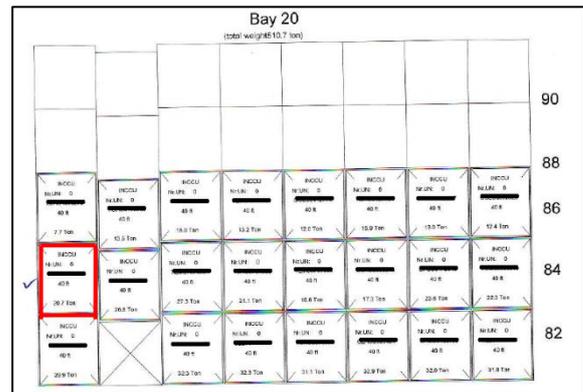
In the morning of 28 September 2020, during his 0400 to 0800 anchor watch, the chief officer noticed a container on deck emitting smoke (Figure 2). The master, who was also on the bridge at that time, noticed the smoke as well, and instructed the chief officer to investigate further.



**Figure 2: Visible smoke coming over the vessel's port side**

<sup>3</sup> Unless otherwise specified, all times in this report are local times (UTC + 5.5).

At around 0730, as soon as the chief officer reached Bay 20, he noticed smoke bellowing from a container in position Bay 20, Row 08, Tier 84 (200884) (Figure 3). He immediately reported this to the bridge and proceeded to the muster station. The master raised the general alarm at once and all crew proceeded as per vessel's fire contingency plan.



**Figure 3: Deck Bay 20 plan. Container emitting smoke, marked in red**

Within 10 minutes, boundary cooling was commenced using four fire hoses. Since the container was neither a refrigerated cargo nor listed as dangerous cargo, the crew were unaware of its contents<sup>4</sup>. By 0810, the master sent an urgent message to all parties concerned and contacted the central planner to assist in the identification of the cargo inside the smoking container.

Past 0900, information from the charterers revealed that the cargo within the container consisted of rechargeable torches with lithium-ion batteries<sup>5</sup>. The crew then consulted with the relevant EmS<sup>6</sup> in the IMDG Code<sup>7</sup>, for fires involving this type of cargo, seeking guidance to create a water spray from as many hoses as possible.

<sup>4</sup> Cargo manifests for containers containing general cargo were not provided on board.

<sup>5</sup> UN 3480 / 3481.

<sup>6</sup> Emergency schedules.

<sup>7</sup> IMO. (2018). *International Maritime Dangerous Goods Code*. London: Author.

Although boundary cooling was continuous from all sides, the smoke was noticed to have increased in intensity. By noon time, after receiving reports that flames were visible from time to time, the master ordered another fire hose to be rigged for boundary cooling.

At around 1230, the flames subsided but the smoke remained. The container was constantly monitored, and boundary cooled. Later in the day, Indian Coast Guard officials made several attempts to board the vessel to assist the crew in the firefighting; however, their boarding was unsuccessful due to the high swell in the area.

At 2200, a fire-fighting tugboat approached and assisted with boundary cooling from the vessel's port side. Until midnight, smoke was still reported to have been emanating from the forward part of the container's roof. At 0130, on 29 September, the fire-fighting tugboat was requested to stand down, since arrangements were made for the vessel to berth at Kolkata.

At 1430, *X-Press Godavari* berthed port side alongside and, shortly after, the container on fire was unloaded (Figure 4).



**Figure 4: Unloading of the container**

During unloading operation, a section of the bottom of the container was displaced, and part of the burning cargo fell on the roof of the container below. This was immediately tackled by the crew on board, while a shore fire-fighting brigade used foam extinguishing media to extinguish the fire within the container.

Until 2112 on 29 September (the time at which *X-Press Godavari* cast off from the berth to shift to another one), the fire was still being tackled by shore fire-fighters.

### **Details on the container and its cargo**

The cargo manifest of the container, as provided to the vessel upon the master's request after the fire was detected, indicated that 500 cartons of lithium-ion batteries<sup>8</sup>, having a gross weight of 7,450 kg, were stowed inside the 40-foot container.

The cargo manifest also indicated that '345 cartons of rechargeable torch (6,010 kg) and 248 cartons of rechargeable torch spare (3,301 kg)' [*sic*] were within the container.

The cargo within the container had originated from China and was bound to be delivered in Kolkata, India.

The following cargo documents were also supplied by the shipper after the fire:

- *Material Safety Data Sheet (MSDS)*  
This included, amongst others, information on the cargo composition, first aid measures and fire-fighting measures<sup>9</sup>. Included were also measures to be taken on the stowage and handling of the cargo. Of particular interest to the safety investigation, were the instructions to store the cargo in a cool, dry, well-ventilated place, with temperatures

<sup>8</sup> HS Code 8507600090 having commodity name *Other lithium-ion accumulators*.

<sup>9</sup> This matter will be analysed in more detail in the next section.

ranging from 20 °C to 30 °C, and not to expose the cargo to direct sunlight for prolong periods.

- **Certificate for Safe Transport**

This included details of the packaging and tests on the samples of cargo, which were carried out by a shore-based testing company. This document further certified that in accordance with special provision (SP) 188<sup>10</sup> of the IMDG Code, the goods were not restricted to the IMDG Code and were packaged in accordance with package requirements of ordinary goods. SP 188, point 6 specified that each package, which was declared to weigh 10.47 kg each, had to be marked with the appropriate lithium battery mark (Figure 5).



**Figure 5: One sample package marked with the lithium battery mark**

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<sup>10</sup> Chapter 3.3 of the IMDG Code includes a list of SPs, which can be applied to certain commodities. If these commodities fulfil the requirements of the applicable SPs, they are not considered dangerous and, therefore, need not be declared by the shipper in accordance with the IMDG Code. The following are specific requirements of SP188:

1. Lithium Content / Watt hour rating for cells;
2. Aggregate lithium content / Watt hour rating for batteries;
3. Manufacturing and testing;
4. Packaging;
5. When Installed in equipment;
6. Package marking;
7. Drop test of package; and
8. Gross mass of packages.

## **Lithium-ion batteries and related fire hazards<sup>11</sup>**

The materials of the anode (positive electrode) and the cathode (negative electrode) in a lithium-ion battery serve as a host for the lithium ions. An electrolyte provides the medium for transport of the lithium ions. These ions move from the anode to the cathode during discharge and are deposited on the cathode. During charging, the ions reverse direction. A separator is installed between the anode and the cathode to block the passage of electrons through the electrolyte *i.e.*, within the battery.

The components of a lithium-ion battery are very thin, fragile and under pressure, since these batteries are designed to be lightweight and compact. If a separator is punctured or damaged, contact between the anode and the cathode is likely to happen, which may lead to an internal short circuit and the generation of excessive heat (and possible fire).

Additionally, another condition which may cause the lithium-ion battery to catch fire or explode is storage in an area of excessive heat, which would eventually cause the electrolyte to evaporate and release toxic / flammable vapours, as well as cause the separator to melt and allow the electrodes to make contact.

The MSDS for the lithium-ion batteries outlined the cargo's hazards. It cautioned that excessive heat may cause venting of the liquid electrolyte. It further stated that the battery may burst and release hazardous decomposition products when exposed to a fire. The fire-fighting measures included the use plenty of water, dry-chemical powder, or carbon dioxide.

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<sup>11</sup> Further information on Li-ion batteries and their hazards can be found in the MSIU's safety investigation report on the fire on board the motor yacht *Kanga* ([Safety Investigation Report 16/2019](#)).

## ANALYSIS

### Aim

The purpose of a marine safety investigation is to determine the circumstances and safety factors of the accident as a basis for making recommendations, and to prevent further marine casualties or incidents from occurring in the future.

### Probable cause of the fire

The vessel had experienced environmental temperatures reaching 30 °C during her four-day voyage to Kolkata and while at anchor at Sandheads Anchorage. Taking into consideration the above, and the fact that the container in question was placed on the outermost row of bay 20, where it would have been exposed to direct sunlight, the MSIU believes that the temperature inside the container may have been higher than the outside temperature.

As mentioned elsewhere in this safety investigation report, the MSDS of the cargo instructed that the batteries had to be stored in a cool, dry, well-ventilated area, with preferable temperatures ranging from 20 °C to 30 °C. Considering the potential high temperature inside the container, it was not excluded that the required storage conditions may have not been met during the voyage.

In the absence of any conclusive evidence, the safety investigation hypothesised that the high temperatures inside the container may have led to the evaporation of the electrolyte and / or melting of the separator in some of the batteries, resulting in an internal short circuit, generation of further heat, and the release of flammable vapours.

Over 7,000 kg of lithium-ion batteries were being carried inside the container. Even if a single battery had to catch fire, there was nothing which could have prevented the fire from spreading inside the container and consuming the rest of the cargo.

### Container fires

Over the years, numerous container fires have been reported and several safety investigation reports have been published, highlighting the dangers of container fires. The most recent and widely known container 2018 fire on board the *Maersk Honam*, which had claimed the lives of five crew members. The safety investigation<sup>12</sup> into this fire identified that the most likely source of the fire was a container carrying a cargo of SDID<sup>13</sup>.

SP 135 allowed for this cargo to be classified and shipped under Class 9 of the IMDG Code (rather than Class 5.1), thus masking the potential thermal instability of SDID. On *Maersk Honam*, the container was stowed underdeck, where the main fixed fire-fighting medium (CO<sub>2</sub>), was ineffective to extinguish fires associated with such a chemical.

In the case of *X-Press Godavari*, the crew members were unaware that the container was stowed with hazardous cargo, since SP 188 allowed for this container to be shipped without being classified as carrying dangerous goods. Early identification of the smoke and the crew's timely execution of boundary cooling of the container placed the vessel at an advantage to successfully control and mitigate the fire's spread.

For approximately 90 minutes, until the charterers confirmed by email that the cargo was rechargeable torches and lithium-ion batteries, the crew members were unaware of the cargo fire, which they were fighting. This was an extremely hazardous situation for the crew, considering that certain cargoes react adversely with water and, therefore, would require a different fire extinguishing media.

The cargo's MSDS indicated that plenty of water, dry-powder and CO<sub>2</sub> were the extinguishing media to be used in case of a

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<sup>12</sup> [Safety Investigation Report MIB/MAI/CAS.035](#).

<sup>13</sup> Sodium Dichloroisocyanurate Dihydrate (SDID).

fire. The vessel was neither equipped with dry-powder nor CO<sub>2</sub> in the quantities sufficient to extinguish a fire in a 40-foot container. Although water was available in copious quantities, there were no available means for the crew to flood the container with water. The crew's only viable option was to apply boundary cooling and wait for all the cargo to burn itself out.

SOLAS<sup>14</sup> regulation II-2/10.7.3 requires vessels which are designed to carry containers on or above the weather deck, and constructed on or after 01 January 2016, to carry at least one water mist lance<sup>15</sup>. Since *X-Press Godavari* was built in 2008, this regulation did not apply to the vessel.

### Special provisions of the IMDG Code

In 2019, the Republic of Liberia along with several non-governmental organizations had submitted document CCC 6/6/17<sup>16</sup> to the IMO's Sub-Committee on the Carriage of Cargoes and Containers (CCC), to discuss the problem of non-declaration and misdeclaration of dangerous goods and proposed a comprehensive review of maritime SPs contained within the IMDG Code, specifically the SPs starting from 900. Taking this document into consideration the CCC established a correspondence group to review the specified SPs and information relating to problems with their application.

In 2020, the correspondence group (CG) report<sup>17</sup> was submitted to the CCC. It referred to, inter alia, SP 963, which exempted nickel-metal hydride (NiMH) batteries when the total quantity in a cargo transport unit (CTU) did not exceed 100 kg gross weight. It further noted that the application of this SP would be difficult when several consignments from different shippers, each not exceeding 100 kg, are packed in a CTU wherein their sum exceeded 100 kg.

Furthermore, the CG requested the CCC to invite interested delegations to submit proposals for improved documentation requirements, to ensure that crew members are informed about exempted cargoes on board. In view of this request, Liberia, and the co-sponsors of document CCC 6/6/17 proposed amendments to the IMDG Code, specifically, the documentation for dangerous goods, including those exempted by SPs<sup>18</sup>.

The proposal recognised that correct documentation and information for dangerous goods, including goods exempt through SPs, were not always provided to the carrier. Consequently, carriers faced challenges to follow appropriate processes, statutory requirements, and industry-developed guidance on risk-based stowage<sup>19</sup>.

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<sup>14</sup> IMO. (2019). International convention for the Safety of Life at Sea, 1974, as amended. London: Author.

<sup>15</sup> A water mist lance consists of a stainless-steel piercing nozzle, which attaches to the vessel's fire main's system. This allows for a water mist to be produced inside a container and, thus, attack the fire directly.

<sup>16</sup> Liberia, ICS, IUMI, BIMCO, ICHCA, International Group of Protection & Indemnity Associations, . . . WSC. (2019). Amendments to the IMDG Code and supplements: non-declaration of dangerous goods – special provisions in the IMDG Code. In *Sub-Committee on Carriage of cargoes and Containers, CCC 6/6/17*. London: IMO.

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<sup>17</sup> Germany. (2020). Amendments to the IMDG Code and supplements: report of the correspondence group on a review of maritime special provisions. In *Sub-Committee on Carriage of cargoes and Containers, CCC7/6/2*. London: IMO.

<sup>18</sup> Liberia, ICS, IUMI, BIMCO, ICHCA, International Group of Protection & Indemnity Associations, . . . WSC. (2020). Amendments to the IMDG Code and supplements: documentation requirements for exempted dangerous goods. In *Sub-Committee on Carriage of cargoes and Containers, CCC 7/6/12*. London: IMO.

<sup>19</sup> Cargo Incident Notification System (CINS). (2019). *Safety Considerations for Ship Operators Related to Risk-Based Stowage of Dangerous Goods on Containerships*. Retrieved from <https://www.cinsnet.com/wp-content/uploads/2019/11/CINS-DG-Stowage-Considerations-Final.pdf>.

It should be noted that the aforementioned industry-developed guidance recommended that declared dangerous goods, and commodities not subject to the full requirements of the IMDG Code through application of an SP, should not be stowed on deck without being protected from direct sunlight, in order to avoid exposure to heat.

While noting that the work of the CG and the original proposals were specifically aimed at SPs 900 onwards, the MSIU identified similarities in its findings with respect to the circumstances surrounding the fire on board *X-Press Godavari*.

SP 188 allowed for the cargo of lithium-ion batteries to be shipped undeclared. The shipper had followed the special provision's instructions and had also been given a Certificate for Safe Transport of the cargo by a certification company. Every package inside the container was labelled in accordance with the requirements of SP 188<sup>20</sup>, which automatically did not require further labelling / marking provisions of the IMDG Code to be followed.

Furthermore, SP 188 limited the gross mass of each package to 30 kg; however, it neither limited the total quantity, nor the weight when shipping several packages inside a container. In the case of *X-Press Godavari*, the container was carrying more than 7,000 kg of lithium-ion batteries in packages of 10.47 kg each.

Although the packages inside the container was affixed with the lithium battery mark, the crew had no information on the cargo<sup>21</sup>.

The container being shipped as general cargo on deck, was stowed on the outermost row of

Bay 20 and, thereby, exposed to direct sunlight. This, while it posed a fire hazard for the cargo inside the container, provided an early, readily visible warning of the fire to the crew. Had it been stowed under deck or had it started to emit smoke during the night, *X-Press Godavari* would have faced a very different and a more challenging situation.

24 hours after the smoke was first observed, the fire inside the container had not yet been completely extinguished, suggesting that several lithium-ion batteries were still on fire. Assistance for *X-Press Godavari* was readily available only because the vessel was anchored at Sandheads Anchorage. The MSIU is convinced that the dynamics of this accident would have been different, had the vessel been out at sea and assistance not readily available.

The safety investigation acknowledged that many variable outcomes, whether less serious or more serious, could have emerged from this accident. However, a fire at sea is a potentially catastrophic situation for crew members. The best possible way to fight a fire at sea, is by taking early and well-informed actions to control and extinguish it. In this accident, the MSIU believes that the crew members' position was compromised and exposed to significant risk.

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<sup>20</sup> SP 188 refers to the lithium battery mark as defined in Chapter 5.2.1.10 of the IMDG Code. Provisions in section 5.2 of the code are aimed at marking / labelling dangerous goods according to their properties.

<sup>21</sup> Crew members have no access to the cargo inside the container.

## CONCLUSIONS

1. The probable cause of the fire was a short circuit of a lithium-ion battery, due to possible high temperatures within the container.
2. The container was not declared as dangerous cargo since it was being shipped under SP 188 of the IMDG Code.
3. SP 188 requires that packages be labelled with a lithium battery mark; however, it does not require the container, within which such packages are stowed, to be marked with the same, thereby rendering the vessel's crew unaware of the hazards within.
4. The crew members were unaware of the container's contents and had to contact the charterer to obtain the information at a very critical time.
5. The observation of smoke permitted the crew members to commence boundary cooling at an early stage.
6. The vessel had no available means to extinguish the container fire and could only apply boundary cooling.
7. The vessel's location at the time of fire was ideal for shore assistance to be provided and, thus, prevent the fire from spreading further and beyond control.

## SAFETY ACTIONS TAKEN DURING THE COURSE OF THE SAFETY INVESTIGATION<sup>22</sup>

Sea Consortium PTE Ltd. took the following safety actions following this occurrence:

- a briefing was held with the master on the requirement of proper documentation of carriage for dangerous good and special cargo.

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<sup>22</sup> **Safety actions shall not create a presumption of blame and / or liability.**

- charterers were required to ensure that shippers properly declare the contents of the cargo.
- the master conducted a safety meeting with all crew members to discuss the accident.
- the Company sent a Fleet Circular across to inform all vessels of this occurrence.

The flag State Administration of Malta prepared an Information Notice, recommending owners of container vessels, constructed before 01 January 2016, and designed to carry containers on or above the weather deck, to also provide water mist lances on board, having the same specifications prescribed in the SOLAS Convention<sup>23</sup>.

## RECOMMENDATIONS

In view of the safety actions taken by the Company and the flag State Administration, no recommendations have been issued by the MSIU.

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<sup>23</sup> The MSIU and the flag State Administration discussed the possibility for the latter to present a paper to the IMO's CCC Sub-Committee for the consideration of the proposal that all containers carrying lithium-ion batteries, are marked in accordance with the provisions of the IMDG Code, irrespective of the quantities being carried.

It was eventually concluded that the proposal was not an option, because the process involves part of the industry, which is not directly linked to the flag State Administration. Moreover, the flag State Administration expressed concern on the logistical backlash, which this measure may trigger.

**SHIP PARTICULARS**

Vessel Name:	<i>X-Press Godavari</i>
Flag:	Malta
Classification Society:	Korean Register of Shipping (KR)
IMO Number:	9353735
Type:	Container Ship
Registered Owner:	BS Marine PTE Ltd
Managers:	Sea Consortium PTE Ltd, Singapore
Construction:	Steel
Length Overall:	154.85 m
Registered Length:	144.90 m
Gross Tonnage:	8971
Minimum Safe Manning:	13
Authorised Cargo:	Containerised cargo

**VOYAGE PARTICULARS**

Port of Departure:	Port Klang, Malaysia
Port of Arrival:	Kolkata, India
Type of Voyage:	International
Cargo Information:	Cargo in containers (9094.3 mt)
Manning:	15

**MARINE OCCURRENCE INFORMATION**

Date and Time:	28 September 2020, at 0730 (LT)
Classification of Occurrence:	Less Serious Marine Casualty
Location of Occurrence:	20° 58.9' N 088° 13.3' E
Place on Board	Main deck
Injuries / Fatalities:	None reported
Damage / Environmental Impact:	Damage to cargo
Ship Operation:	At anchor
Voyage Segment:	Anchored
External & Internal Environment:	The sky was clear with a visibility of 6 nm. The sea was calm, and the wind was Southwesterly, Force 3. The air and sea temperatures were 28 °C and 29 °C, respectively.
Persons on board:	15