

FINAL REPORT

FATAL INJURY ON BOARD SG VICTORY IN HULHUMALE, MALDIVES ON 17 MAY 2016

MIB/MAI/CAS.001

**Transport Safety Investigation Bureau
Ministry of Transport
Singapore**

9 October 2017

The Transport Safety Investigation Bureau

The Transport Safety Investigation Bureau (TSIB) is the air and marine accidents and incidents investigation authority in Singapore, responsible to the Ministry of Transport. Its mission is to promote aviation and marine safety through the conduct of independent and objective investigations into air and marine accidents and incidents.

The TSIB conducts marine safety investigations as required by SOLAS Regulation XI-1/6 in accordance with the International Maritime Organisation's (IMO) Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (Casualty Investigation Code), as adopted by Res. MSC 255(84).

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SYNOPSIS

This is a marine safety investigation report into the very serious marine casualty involving the fatal injury of the Chief Officer on board the Singapore registered tug boat SG Victory at Hulhumale, Maldives, on 17 May 2016. The accident occurred at about 1630H Maldives time.

SG Victory had towed the barge MJS 3001, carrying granite in bulk, from India to Hulhumale. The unloading of the granite involved beaching the barge at Hulhumale. To maintain the barge's beached position during the cargo unloading operation, the barge needed to be secured on the side of the tugboat using the tug's mooring ropes (one headline and one stern line). The stern line was passed via the underside of the side guard preventer pipe, on the port side at the stern of the tug, instead of being passed through a closed fairlead.

With an onset of adverse weather, the tug and barge rolled and pitched in tandem moderately and, at times, heavily. This caused the headline and stern line to slacken and tighten alternately. At one point during the tug's rolling and pitching, the stern line slipped out from the preventer pipe, sprang sideways and hit the back of the head of the Chief Officer, who after the mooring operation was walking on the open deck of the tug with the mooring crew, towards the tug's accommodation.

The Chief Officer suffered a whiplash injury and fell unconscious. He was sent to the local hospital and was transferred to a hospital in Male, Maldives. He was later flown to Singapore on 21 May 2016 for treatment and subsequently to his hometown in Indonesia. He succumbed to his injuries on 25 September 2016.

The occurrence was a result of the inappropriate use of the side guard preventer pipe as a fairlead for the mooring rope to secure the barge to the tug.

DETAILS OF SHIPS INVOLVED

Tug boat details

| | |
|------------------------|------------------------------------|
| Name | SG Victory |
| IMO Number | 9491276 |
| Call Sign: | 9V7437 |
| Flag: | Singapore |
| Classification society | DNV GL |
| Ship type | Tug boat (Non-SOLAS ¹) |
| Builder | Sibu, Malaysia |
| Year Built | 2007 |
| Owner/Company | Star Global Marine Pte Ltd |
| Manager | Star Global Agency Pte Ltd |
| Gross tonnage | 261 |
| Length overall | 30.0m |
| Moulded breadth | 8.60m |
| Draught designed | 3.50m |
| Main engine(s) | Cummins KTA38-M2 |
| Total power | 1200Hp @ 1800RPM x 2 |
| Maximum speed | About 11 knots |
| Bollard pull | Approximate 30 Tons |

View of SG Victory from the stern



The tug was designed for pushing, stern towing and side towing operations.

¹ Non-SOLAS ship – A ship in respect of which the application of International Safety Management code is not mandatory. Vessel certified under Merchant Shipping Act (Non-Convention) Safety Regulations

Barge details

| | |
|---------------|--|
| Name | MJS 3001 |
| Year built | 2015 |
| Flag | Indonesia |
| Ship type | Non-propelled barge (deck cargo) |
| Size | About 91.4m x 24.4m x 5.5m |
| Sideboard | About 3m height with portable door |
| Condition | Laden with cargo of granite rock in bulk |
| Draught laden | About 1.0m |

View of barge MJS 3001 during dry dock



1 FACTUAL INFORMATION

All times used in this report are Maldives times. Maldives time is five hours ahead of Coordinated Universal Time (UTC).

1.1 Sequence of events

1.1.1 On 15 May 2016 at about 2000H, the tug boat SG Victory and barge MJS 3001 anchored at the outer anchorage of Hulhumale, Maldives, to wait for berthing instructions. SG Victory had towed MJS 3001 from India to Maldives². MJS 3001 was loaded with cargo of granite in bulk.

1.1.2 On 17 May 2016 at about 1500H, SG Victory was instructed by Hulhumale Port Control to proceed into port for discharging operation. The Master called the crew for mooring stations.

1.1.3 The discharging operation would usually involve beaching³ the barge and trucks would then unload the granite from the barge (see Fig. 1).



Fig. 1 – Typical beaching operation for illustration

² The tug and barge had been operating between Tuticorin, India and Hulhumale, Maldives since January 2016, calling at Hulhumale every 20 days.

³ Beaching is the process in which a ship or boat is laid ashore, or deliberately grounded in shallow water. This is more usual with small flat-bottomed boats. Some vessels are designed to be loaded and unloaded by beaching.

- 1.1.4 At about 1510H, the Master positioned SG Victory ahead of the barge for stern towing, while a local tug boat “Fumunu”, acting as an assist tug was secured on the barge’s port quarter. SG Victory towed MJS 3001 from the anchorage to the beaching position using a short tow line⁴ of about 50m.
- 1.1.5 At about 1545H, when the barge was about 100m from the planned beaching position, the Master instructed the crew to disconnect the towline. He then positioned SG Victory at the stern of the barge to gently push her towards the sandy beach.
- 1.1.6 At about 1620H, after the barge was uneventfully beached ashore, the Master re-positioned SG Victory on the starboard quarter of the barge (in a side towing operation position) to hold her in beached position for discharging the granite.
- 1.1.7 The Master instructed the crew to secure the tug to the barge with two mooring ropes (one head line and one stern line). He did not give specific instructions on how the lines were to be passed. He left the mooring operations to the Chief Officer, who was in charge of the mooring on board the tug. The Master was controlling the tug’s position using the tug’s forward (main) controls on the Bridge. From this position, he could occasionally glance at the working deck aft through the aft bridge windows.
- 1.1.8 The tug’s mooring arrangement was typically as follows:
- (a) The head line should be passed underneath the forward towing bracket and secured to a bollard on board the tug; and
 - (b) The stern line should be passed through the closed fairlead (see Fig. 2), located about 4m forward of the aft end of the tug, and secured to a bollard on board the tug.

⁴ Short tow is generally employed in coastal waters to allow the tug and tow to react much faster when required.

Closed fairleads are designed for stern line mooring, especially when there is a height difference between the tug and the barge (which was about 2 metres in this occurrence).

Plan view of design for mooring arrangement

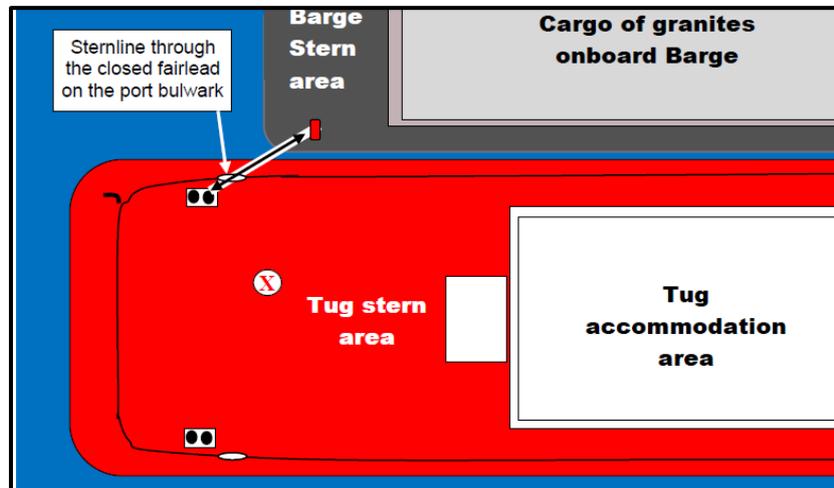


Fig. 2 – Stern line if passed through closed fairlead

- 1.1.9 In this occurrence, the head line was passed underneath the forward towing bracket, as in a typical arrangement. The stern line, however, was passed via underside of side guard preventer pipe⁵ located at the port side of the side guard opening (see Fig. 3 and 4). The crew carried out the mooring operations under the guidance of the Chief Officer. It was revealed that the operations were as per past practices.

⁵ During stern towing operations, when the height of the securing point of the vessel being towed is higher than the towing point on board the tug, or when the tow-wire is under tension, the tow wire might move sideways and shift beyond the side guard opening. The cowl shaped preventer pipes on both sides of the side guard opening are to prevent such a situation.

Starboard side view of the tug and barge

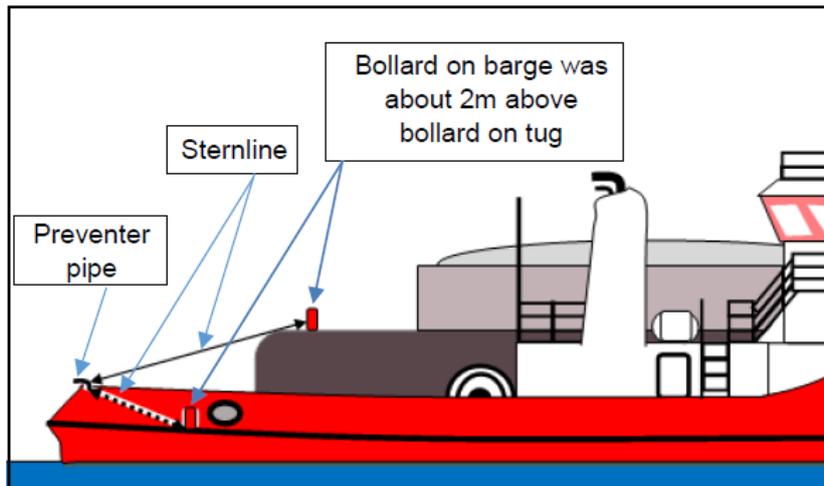


Fig. 3 – Stern line passed via open ended pipe

Plan view of tug and barge

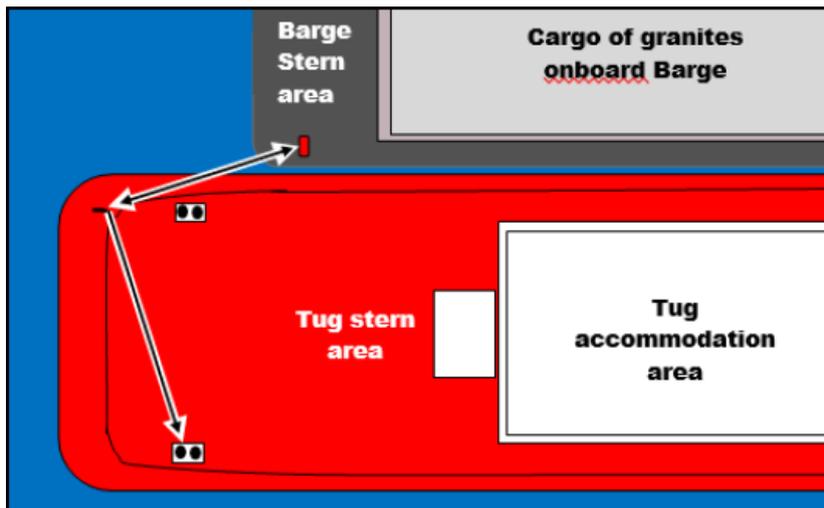


Fig. 4 – Stern line passed via open ended pipe

- 1.1.10 The Chief Officer and the crew completed the mooring operation at about 1630H and were returning to the tug's accommodation when the weather deteriorated.
- 1.1.11 As a result, the tug and barge rolled and pitched in tandem moderately and, at times, heavily. With every rolling and pitching movement of the tug and barge, the headline and stern line slackened and tightened alternately.

1.1.12 During one of these movements, the stern line slipped out from the side guard preventer pipe (see Fig. 5 and 6), sprang forward and reportedly hit the Chief Officer⁶ at the base of his head as he was walking on the open deck of the tug towards the tug's accommodation.

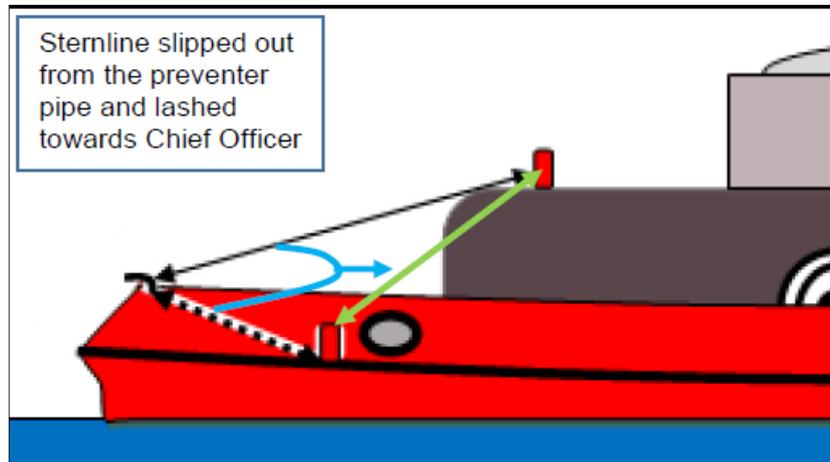


Fig. 5 – Stern line slipped out from the preventer pipe



Fig. 6 – Stern line slipped out from the preventer pipe

1.1.13 The Chief Officer fell backwards, lay motionless and unconscious. The crew immediately rushed to render assistance and reported the accident to the Master. The Master immediately called the tug company and the local agent for medical assistance.

⁶ The Chief Officer was wearing appropriate personal protective equipment, including a safety helmet, as required by the company's safety management system.

1.2 Injuries sustained

1.2.1 The injured Chief Officer was transported to the Hulhumale Hospital at about 1700H. He was later transferred to the Indira Gandhi Hospital in Male, Maldives. The Chief Officer suffered multiple head injuries.

1.2.2 He was then flown to Singapore on 21 May 2016 for treatment at Tan Tock Seng Hospital. Subsequently, at the request of his relatives, he was flown back to his hometown in Indonesia to receive further treatment. He succumbed to his injuries on 25 September 2016.

1.2.3 No other crew member of the tug were injured in the occurrence.

1.3 Post-accident inspection

- The aft mooring station was clear of obstructions;
- The stern line was in satisfactory condition, and there was no failure of the rope;
- There were no signs of damage to the side guard preventer pipe.

1.4 Manning

1.4.1 The tug's manning comprised the Master, Chief Officer, Second Officer and nine other crew members. All Officers and crew members held valid STCW⁷ certificates. The Master held a valid Certificate of Competency appropriate for the vessel and issued by the relevant Indonesian authorities. The Master had about 10 years of command experience on various types of vessels before joining SG Victory on 1 May 2016.

1.4.2 The Chief Officer held a valid Certificate of Competency appropriate for the vessel and issued by the relevant Indonesian authorities. The Chief Officer had more than five years of experience as an officer-in-charge of mooring

⁷ The International Convention on Standards of Training, Certification and Watch keeping for Seafarers (or STCW) 78 as amended, sets qualification standards for masters, officers and watch personnel on seagoing merchant ships.

operations before joining SG Victory on 1 December 2015. He had previously sailed on the SG Glory, which was a SOLAS-compliant ship under the same company.

1.4.3 At about the time of the accident, the Master was on the bridge operating the tug but did not witness the occurrence. The positions of the officers and crew (see Fig. 7) members were as follows:

- The Chief Officer was on the aft deck of the tug boat and was assisted by the Second Engineer, Third Engineer and two ratings.
- The Second Officer was on the deck of the barge and was assisted by three ratings.

1.4.4 The dotted red line represents how the stern line was initially moored and the solid red line represents the stern line's position at the time of the accident.

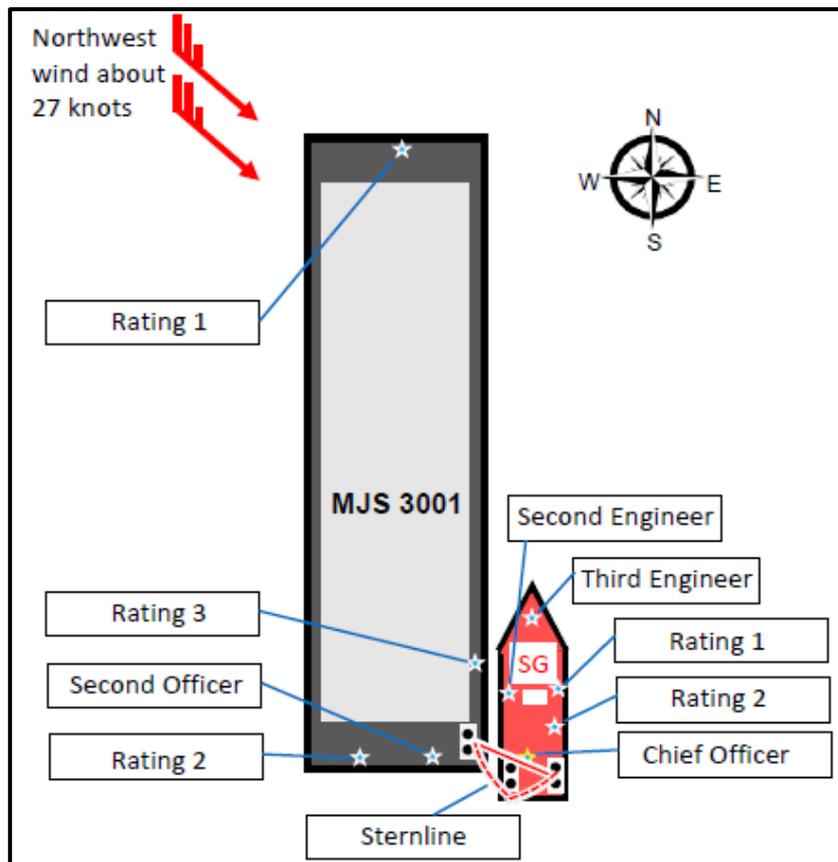


Fig. 7 – Position of officers and crew on board

1.4.5 The rest hours log record maintained by each officer and crew indicated that they had adequate rest before being called for mooring station duties.

1.5 **Damage to vessels**

There was no damage to SG Victory or MJS 3001. Both vessels were reported to be seaworthy by the Master.

1.6 **Meteorological condition**

The weather at Hulhumale on 17 May 2016 was reported as follows:

- At about 1200H - Partly cloudy with west-southwest wind at about 20 knots. The sea was light to moderate.
- At about 1700H - Partly cloudy with northwest wind at about 27 knots. The sea was moderate to rough.

1.7 **Safety Management System (SMS)**

1.7.1 At the time of the accident, the tug company operated four tug boats, viz. SG Victory (261 gross tons), SG Glory (764 gross tons), SG Splendour (131 gross tons) and SG Peace (157 gross tons)⁸.

SG Glory was a SOLAS⁹ certified ship, being of more than 500 gross tons and engaged in international voyages. Thus, the tug company needed to comply with the International Safety Management (ISM) Code as required by SOLAS. The company had a valid Document of Compliance (DoC) and a Safety Management Certificate (SMC)¹⁰ for the SG Glory.

⁸ Except SG Peace which was Indonesian registered, all other tug boats were registered under Singapore Flag.

⁹ SOLAS - The International Convention for the Safety of Life at Sea

¹⁰ The DoC is accepted as evidence that a company is capable of complying with the requirements of the ISM Code, in respect of the SOLAS ship concerned. The SMC is accepted as evidence that the ship is complying with the requirements of the ISM Code.

- 1.7.2 A SMC was not required for other three vessels, i.e. SG Victory, SG Splendour and SG Peace, as they were non-SOLAS ships. However, the tug company had been voluntarily implementing some¹¹ of the same “Safety Management System” (SMS) that was required to be implemented in respect of SG Glory, for the three non-SOLAS ships.
- 1.7.3 The SMS contained organizational policies, procedures, manuals, checklist, etc. A Procedure Manual provided guidance to the crew for shipboard situations such as -:
- Preparation for arrival port;
 - Navigation in adverse weather conditions; and
 - Tug anchor handling/ submarine rescue operation/ operating near offshore installations, etc.
- 1.7.4 Section 4 of the Procedures Manual provided guidance on Risk Assessment for the ship’s crew to identify and reduce the hazards and risks involved in non-routine operations. The tug did not have a typical mooring layout associated for towing of barges.
- 1.7.5 The Procedures Manual had a generic reference to Code of Safe Working Practices for shipboard operations (COSWP)¹². At the time of the incident, a copy of COSWP was not found onboard.
- 1.7.6 The tug company’s staff in charge of implementation of the SMS for the day-to-day operations of tug boats comprised of one Operations Superintendent, who was also the company’s Designated Person Ashore (DPA)¹³, one Senior Manager and one Technical Superintendent.

¹¹ Safe practices such as Standard Operating Procedures (SOP), drills and reporting procedures had been initiated to be practiced on the other three non-SOLAS ships

¹² The COSWP published by the UK Maritime and Coastguard Agency (MCA) provides best practice guidance for improving health and safety on board ships. The MCA requires UK registered ships to carry the COSWP on board.

¹³ As required by ISM Code 4, the responsibility and authority of a DPA includes monitoring the safety and pollution prevention aspects of the operation of each ship and ensuring that adequate resources and shore based-support are applied.

1.8 Code of Safe Working Practices for Merchant Seafarers (COSWP)

1.8.1 The COSWP is a widely used reference publication by the industry for safe working practices on board ships. The tug company confirmed that their vessels did not carry a copy of the COSWP¹⁴.

1.8.2 Guidance on securing and casting off during anchoring, mooring and towing operations, the COSWP states:

Chapter 26.3.2

Owing to the design of mooring decks, the entire area should be considered a potential snap-back zone. All ratings working on a mooring deck should be made aware of this with clear visible signage.

Chapter 26.3.7

Equipment used in mooring operations should be regularly inspected for defects. Pedestal roller fairleads, lead bollards, mooring bitts, etc., should be:

- properly designed for the task;
- able to meet all foreseeable operational loads and conditions; and
- Correctly sited.

Chapter 26.3.11

Pre-planning of such operations is essential and a risk assessment of the operation must be completed, especially in cases where unusual or non-standard mooring arrangements are used.

Chapter 26.3.13

When mooring lines are under strain, all personnel in the vicinity should remain in position of safety, i.e. avoid the snap-back zone.

¹⁴ The Maritime and Port Authority of Singapore (MPA) does not mandate Singapore registered ships to carry the COSWP or a similar document on board.

2 ANALYSIS

2.1 Shipboard Personnel

2.1.1 The occurrence was the result of incorrect and inappropriate lead being used for the stern line by shipboard personnel, i.e. led via the side guard preventer pipe instead of the closed fairlead to secure the barge to the tug.

2.1.2 The preventer pipe was never designed to be used and should never be used as a fairlead. The Chief Officer, and for that matter the Master and all other crew members, ought to have known this, as appropriate use of fairleads constitutes basic seamanship. It had been fortunate that nothing untoward happened when this same practice had been used on earlier occasions, but not this time. The Chief Officer being an experienced officer like the Master, was expected to have sufficient knowledge to realise the danger of using equipment not designed for its intended purpose. This was considered as the primary causal factor¹⁵ to the accident.

2.1.3 The crew did not challenge the unsafe act of using the preventer pipe as a fairlead. This is indicative of a lack of safety awareness in general onboard. Whether this was a one-off lapse or symptomatic of a bigger safety culture problem existing in the company, requires the company to conduct an exercise to assess the level of safety culture within its organisation.

2.2 Safety Management System (SMS)

2.2.1 SMS is designed for the safe operations of the ships and also is intended to assign accountability towards personnel involved, be it on board or ashore.

¹⁵ A causal factor means actions, omissions, events or conditions, without which:

- .1 the marine casualty or marine incident would not have occurred; or
- .2 adverse consequences associated with the marine casualty or marine incident would probably not have occurred or have been as serious;
- .3 another action, omission, event or condition, associated with an outcome in .1 or .2, would probably not have occurred.

- 2.2.2 Although the SMS of the company was comprehensive, its partial implementation on board the SG Victory was ineffective, especially the conduct of risk assessment for non-routine operations, such as towing and beaching. The SMS did not differentiate between towing and beaching operations as a routine or non-routine operation, respectively.
- 2.2.3 It was apparent that the company's SMS had not adequately addressed¹⁶ the hazards and risks involved in routine and non-routine mooring operations involving the tugs and barges. There appears to have been a lack of oversight on the part of the company for ensuring implementation of the SMS. Recognising that the company operates an ISM compliant vessel, it would be prudent for the company to establish concise procedures, in particular, for non-routine operations, supplemented with instructions and checklists for compliance.
- 2.2.4 Industry wide research has shown, in general, that safety climate positively influences behaviours of the crew. For a robust organisational safety climate, it is imperative that personnel ashore responsible for ensuring safety policy implementation create a safety climate which is aware of safety issues and behaviour. For such a culture to thrive, continual improvement is key, by reviewing through audits and reporting systems.

2.3 Work location

- 2.3.1 Tugboats and offshore vessels provide ample areas for risks to increase considerably in comparison to typical conventional merchant vessels, owing to their relatively small working size, the operating conditions, the restricted working area on deck amongst others. Mooring areas are widely recognised as potential snap back zones where whiplash of mooring ropes can cause substantial damage to individuals and property. The whiplash could either occur as a result of parting of ropes or as a result of release in tension of a

¹⁶ ISM Code 7 – The Company should establish procedures, plans and instructions, including checklists as appropriate, for key shipboard operations, concerning the safety of personnel, ship and protection of the environment. The various tasks should be assigned to qualified personnel.

strained rope, as was in this case, in particular, during adverse weather condition where the mooring lines would come under severe strain. Chapter 26.3.2 and 26.3.13 of COSWP lays emphasis that personnel in the vicinity should remain in a position of safety, i.e. avoid the snap-back zone.

2.3.2 While the hazards in such a workplace cannot be completely eliminated, their consequences can be minimized by the conduct of appropriate risk assessments. These assessments take into account inputs from the various personnel involved and aim to be an effective tool for implementing risk mitigating measures and help to increase the situational awareness¹⁷ of those involved. It was evident that no such risk assessment was conducted by the crew onboard. It is likely that such a requirement was not enforced by shore based personnel as a result of the inadequacies of the SMS and its compliance on board.

2.3.3 Although the carriage of COSWP is non-mandatory onboard Singapore registered ships, the publication is a useful reference publication that contains good practices and recommendations for a variety of shipboard operations. While the company's SMS made a brief reference to the publication, the vessel was not provided with a copy of this publication.

2.4 Meteorological condition

While the onset of sudden and gusty winds appears to have contributed to the occurrence, the change in meteorological conditions was unlikely to have resulted in the same consequence, had the stern line been passed through an appropriate fairlead.

¹⁷ Lack of situational awareness - An incorrect understanding of the current situation which leads to a faulty hypothesis regarding a future situation, or in this case Chief Officer's incorrect belief that the stern line passing below the preventer pipe would remain in position during rolling and pitching.

3 CONCLUSIONS

From the information gathered, the following findings, which should not be read as apportioning blame or determining liability to any particular organisation or individual, are made.

- 3.1 The statutory certificates for SG Victory were in order, including qualifications of the officers and crew. There is no evidence to suggest anything was amiss with the mooring rope or equipment onboard before the occurrence. Evidence indicated that the Chief Officer and members of the mooring crew had adequate rest before mooring operations, thus, fatigue was not a contributing factor to the accident.
- 3.2 The occurrence was a result of incorrect and inappropriate lead being used for the stern line, i.e. led via the side guard preventer pipe instead of the closed fairlead to secure the barge to the tug, an unsafe act.
- 3.3 There was a lack of safety awareness onboard to report an unsafe act, such as the use of side guide preventer pipe for mooring operations instead of using the closed fairlead.

4 SAFETY ACTIONS

During the course of the investigation and through discussions with the investigation team, the following safety actions were initiated by the tug company.

After the accident, the tug company initiated the following actions:

- Conducting additional training and creating awareness by highlighting the circumstances of the accident to all crew members of its fleet of tug boats, in particular, on the importance of proper and effective mooring operations and the appropriate use of equipment;
- Improving effectiveness of company's oversight and implementation of SMS¹⁸ or equivalent system¹⁹ for shipboard operations to address mooring operations in general for Masters, Officers and Ratings prior joining the vessel and increasing the frequency of audit and oversight of its fleet; and
- Enhancing risk assessment for pre-planning of towing and subsequent beaching operation as a part of non-routine operations.

¹⁸ The International Safety Management (ISM) Code for the Safe Operation of Ships and for Pollution Prevention is a mandatory code under the SOLAS convention. It is non-mandatory for cargo ships of less than 500 gross tons and **may** be applied to all ships.

¹⁹ Star Global booklet for Safety practices on board

5 SAFETY RECOMMENDATIONS²⁰

A safety recommendation is for the purpose of preventive action and shall in no case create a presumption of blame or liability.

The following safety recommendations have been issued:

- 5.1 To the tug company - To ensure that equipment onboard are used as designed and unsafe acts onboard are reported to the company. The company should take appropriate steps to ensure that the side guard preventer pipe is not used as a fairlead for towing and subsequent beaching operations. The purpose of the preventer pipe should be clearly marked onboard their fleet of tugs. **[TSIB-RM-2017-001]**
- 5.2 To the tug company – To take provisions of a publication like the COSWP into account when reviewing its SMS, while paying particular attention to the conduct of risk assessment for non-routine operations, so as to increase awareness of whiplash injuries that may be caused by mooring ropes under strain. **[TSIB-RM-2017-002]**
- 5.3 To the tug company – To implement a system to document the training of officers and crew, and their compliance with company’s risk assessment procedures, taking into account revisions to the company’s safety management system. **[TSIB-RM-2017-003]**
- 5.4 To the Flag Administration – To require and enforce carriage of publication or reference safety guides / codes as stated in the safety management system on board, where applicable, (e.g. COSWP) for meeting the objectives²¹ of the safety management system. In addition, for vessels certified under Merchant Shipping Act (Non-Convention) Safety Regulations to which the ISM Code and Safety Management System does not apply, to

²⁰ Actions taken in response to the recommendations shall be provided in writing to TSIB

²¹ The Safety Management System should ensure the applicable codes, guidelines and standards recommended by the Organisation, Administrations, classification societies and maritime industry organisations are taken into account.

consider and review the need for mandatory carriage of a publication like the COSWP so that the operators of these vessels can take reference from such a publication in the conduct of safe operations onboard. **[TSIB-RM-2017-004]**

End of Report