FINAL REPORT

FATAL INJURY ON BOARD THE BULK CARRIER ASIA ZIRCON I AT THE PORT OF NANSHA ON 8 FEBRUARY 2018

MIB/MAI/CAS.033

Transport Safety Investigation Bureau
Ministry of Transport
Singapore

20 September 2019

The Transport Safety Investigation Bureau

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SYNOPSIS

On 7 February 2018, at about 2030H, the Singapore registered bulk carrier, Asia Zircon I, berthed at Hua Run Terminal for discharging a cargo of coal at the port of Nansha, China.

At about 1910H on 8 February 2018, a team comprising the Second Engineer as the team leader, an Electrician, a Fitter, a General Purpose Trainee and an Oiler was transferring a portable pump with the assistance of four Chinese crew from the sludge barge. The Oiler left the team without informing the others to prepare the engine room overhead crane, fell through the walkway openings from the A-deck platform and landed onto the floor of the engine room tank top. As result of the fall, he succumbed from his serious head injuries.

The TSIB classified the occurrence as a Very Serious Marine Casualty and launched a marine safety investigation.

The investigation revealed that the walkway gratings at A-deck and B-deck platforms in the engine room were left open without fencing and warning notices posted in the vicinity of the openings. The work tasks were not properly planned, risk assessment was lacking and safety briefing was not carried out for the crew members involved.

The investigation also revealed that there was lack of communication amongst the team members to ensure the safety of the crew.

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DETAILS OF THE SHIP

Name	Asia Zircon I
IMO number	9331749
Flag	Singapore
Classification society	Bureau Veritas (BV) / DNV-GL[1]
Ship type	Bulk carrier
Hull	Steel
Date of delivery	26 January 2011
Owners	Maritime Asia Zircon Pte. Ltd.
Operators / ISM[2] Managers	Columbia Shipmanagement (Singapore) Pte. Ltd.
Gross tonnage	32,578
Length overall	190.00m
Moulded breadth	32.26m
Moulded depth	17.50m
Summer draft	12.62m
Cargo onboard	Coal

Asia Zircon I
(*Photo source:* the ISM Manager)

[1] DNV-GL was for carrying out ISM audit and issuance of ISM related certificates.
[2] International Management Code for the Safe Operation of Ships and for Pollution Prevention.

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1 FACTUAL INFORMATION

All times used in this report are local time, eight hours ahead of the UTC (UTC + 8H), unless otherwise stated.

1.1 Sequence of events

1.1.1 On 7 February 2018, at about 1742H, the Singapore registered bulk carrier, Asia Zircon I (AZI) berthed at Hua Run Terminal at the port of Nansha, China. At about 2030H, the discharge of cargo (coal) commenced.

1.1.2 On 8 February 2018, at about 1745H, the Master of AZI received an information by phone from the appointed sludge (oil residues) collection company[3] requesting to bring forward the ship's sludge disposal from 1400H on 9[4] February 2018 to 1830H on 8 February 2018. The Master consulted the Chief Engineer and accepted the change.

1.1.3 Within 15 minutes of the phone call, a sludge barge from the sludge collection company arrived and was made fast to the AZI's starboard side to facilitate the sludge transfer operation. The AZI's Chief Engineer and the Second Engineer discussed the plan for discharging of sludge with the sludge company representative. It was agreed to accept the offer of using a portable pump[5] from the sludge barge (see **Figure 1**) to be brought on AZI for the discharging of sludge.

Figure 1 – Portable pump intended to be used for sludge discharging
(*Photo source:* the ISM Manager)

[3] The company was one of the sludge disposal contractor in China recognised by the Operator.

[4] Initial planned arrangement made by the company in accordance with the ship's schedule known at that time before arriving Nansha. The change was reportedly due to the availability of the barge for the said sludge disposal.

[5] An electrical driven portable sludge discharging pump having a weight of about 165kg. As the portable pump was heavy, the Second Engineer intended to use engine room overhead crane (monorail type).

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1.1.4 The Chief Engineer instructed the Second Engineer to provide assistance to the barge crew for the transferring of the portable pump from the sludge barge to the AZI's engine room. Thereafter, he went back to his cabin to prepare paperwork and other documents for sludge disposal in accordance with the company's procedures.

1.1.5 The Second Engineer met four engineering crew[6] in ship's mess room and asked them to assist in transferring the portable pump from the barge, after they had taken their dinner. At the same time, the following tasks were assigned:

- the Fitter, Oiler and General Purpose Trainee (GPT) were to open the engine room skylight hatch located at starboard side main deck of AZI;
- they were then required to open manholes for each of the bilge tank and sludge tank, from where the oily water mixture was to be discharged ashore;
- they were finally required to open the walkway gratings inside the engine room, located at A-deck and B-deck platforms to facilitate the lowering of the portable sludge pump to the bottom deck (closest deck for the manholes) using the ship's engine room overhead crane;
- the three crew were then join the Second Engineer for the transferring of the portable pump;
- the Electrician was to assist the Second Engineer to operate the ship's provision crane to lift up the portable pump from the sludge barge and transfer it into AZI's engine room through the skylight hatch.

1.1.6 At about 1830H, after having dinner, the four engine crew started performing tasks assigned by the Second Engineer. The Electrician went on deck and assisted the Second Engineer to lift up the portable pump and its associated hoses, first onto the ship's main deck, and then through the skylight hatch into the engine room near the compressor room at A-deck.

1.1.7 With assistance of four Chinese crew from the sludge barge, the Second Engineer and the Electrician were in the process of transferring the portable pump further to a location where it was reachable by the overhead crane in the engine room. A trolley and chain blocks were being used for the transfer as the portable pump was heavy.

[6] It was during the ship's dinner time, an Electrician, a Fitter, an Oiler and a General Purpose Trainee were having their dinner in the mess room.

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1.1.8 While this activity was going on, the other three engineering crew including the Oiler started opening the manholes of the bilge tank and sludge tank located at the engine room tank top.

1.1.9 At about 1845H, the Fitter and GPT proceeded to the B-deck platform after opening the manholes of the tanks, to open the walkway grating, while the Oiler went back to the compressor room to assist the Second Engineer.

1.1.10 After the Fitter and the GPT had opened the two walkway gratings at A-deck and B-deck platforms, both of them then went to assist the Second Engineer. The Second Engineer was advised that the tasks assigned had been completed.

1.1.11 By this time, the portable pump had been shifted to a location near the no.3 auxiliary engine at A-deck (aft side). The overhead crane was still not reachable at this location and all personnel including the Oiler were in the process of shifting the pump nearer to the overhead crane.

1.1.12 At about this time, without informing the team members, the Oiler walked away[7] from the team. None of the team members enquired about the Oiler's intention as they were focusing on moving the portable pump.

1.1.13 At about 1910H, the GPT (who was facing forward of the engine room) saw a flash that appeared like someone falling down to the lower deck platform at the forward part of the engine room. He quickly left the team to see what had happened.

1.1.14 When the GPT arrived at engine room tank top, he saw the Oiler was lying on the tank top floor with his left face down in pool of blood. He immediately went back to the A-deck platform to report to the Second Engineer, who then alerted the Chief Engineer and the Master.

1.1.15 The Oiler was given medical first aid treatment by the ship's crew and subsequently he was evacuated from the engine room. At same time, the Master called the company's appointed local agent for medical assistance. The Oiler was noted to have weak breathing and was unconscious.

1.1.16 At about 2000H, an ambulance arrived at the ship's side and brought the injured Oiler to a local hospital in Nansha.

[7] No evidence to suggest his action was either instructed or by himself voluntarily.

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1.1.17 As a result of the accident, in consultation with the company, the sludge disposal operation was cancelled and the sludge barge was cast off at about 2015H.

1.1.18 At about 2150H, the ship's local agent came on board to advise the Master that the Oiler had succumbed to his injuries at the hospital.

1.2 The crew

1.2.1 At the time of accident, 19 multi-national crew were on board. All crew held valid STCW[8] competency certificates required for their respective positions held onboard.

1.2.2 The qualification and experience of the Master, relevant officers and crew members are listed in Table 1.

Designation onboard	Nationality	Age	Qualification	Duration on board (months)	First time on Asia Zircon I	In rank (Years)	Served in company (Years)
Master	Montenegrin	60	COC[9] – Master	4.5	Yes	5.1	1.5
Chief Officer	Russian Federation	57	COC – Master	1.1	Yes	9.4	4.4
Chief Engineer	Ukrainian	49	COC – Chief Engineer	2.5	Yes	5.1	3.7
Second Engineer	Vietnamese	35	COC – Chief Engineer	1.9	Yes	3.5	1.1
Electrician	Filipino	37	Electrician	2.5	Yes	4.9	8.4
Fitter	Filipino	49	Engine Rating as per STCW	2.5	Yes	2.4	7.1
Oiler	**Filipino**	**31**		**2.5**	**Yes**	**1.3**	**8.6**
GPT	Filipino	21		8.8	Yes	0.7	0.7

Table 1

1.2.3 Having joined the company in 2016, AZI was the Master's fourth ship.

1.2.4 The Chief Officer was, in addition to being the head of the deck department, the designated Safety Officer[10] on AZI. He was not involved in the transfer

[8] The International Convention on Standards of Training, Certification and Watch keeping for Seafarers (or STCW), 1978 sets qualification standards for masters, officers and watch personnel on seagoing merchant ships.

[9] Certificate of competency according to the STCW requirements.

[10] Responsible for ensuring compliance with statutory and company's safety requirements, as well as the provisions of the Maritime and Coastguard Agency's Code of Safe Working Practice. The respective department heads would ensure its own department's operation safety.

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operation of the portable pump. One of his responsibilities as a Safety Officer was to participate in risk management activities conducted on board.

1.2.5 The Chief Engineer was overall in-charge of the ship's engine room, all machinery operations and for the disposal of sludge ashore.

1.2.6 The Second Engineer was responsible to ensure that activities in engine room were well planned, organized and safeguards were established against all identified risks according to the company's procedures. He was at the time of the occurrence involved in and supervising the transfer of the portable pump. He was also the engine room officer of the watch[11] at the time of accident. This was his second ship in the company.

1.2.7 The Fitter had been working with the company for more than seven years. He did not keep engine room watches, but assisted as required and was a team member in the transfer of the portable pump.

1.2.8 The Oiler (deceased), having served in the company longer than the Fitter, joined AZI together with the Fitter. The Oiler's medical certificate for service at sea declared him fit for sea service and was issued on 7 October 2017 with a validity for one year[12]. At the time of accident, he was not on duty[13], but had been asked to assist the team for the transfer of the portable pump.

1.2.9 Though this was GPT's first time in the company, among the team members, he had been the longest on board (8.8months). He was a member of the engine room watchkeeping team[14] and was the first to reach to the Oiler after he fell.

1.2.10 All engineering officers and crew met the STCW and MLC Convention's requirements[15] concerning hours of work and rest according to AZI's rest hour log records.

[11] He kept port watches for the period of 1200H-1800H and 0000H-0600H.

[12] The Oiler had declared a history of hypertension in April 2016, which was managed and controlled with diet and exercise. The validity of the certificate issued by the medical practitioner was shortened to one year instead of a typical two-year, for the purpose of medical surveillance. The same certificate also recommended to the Oiler to continue diet restrictions and exercise.

[13] He kept sea watches with Second Engineer for the period of 0000H-0400H and 1200-1600H, port watches with Third Engineer for the period of 0600H-1200H and 1800H-2400H.

[14] He kept same period of engine room watch as the Second Engineer's in port.

[15] STCW - the International Convention on Standards of Training, Certification and Watch keeping for Seafarers, 1978 and its amendments set qualification standards for masters, officers and watch personnel on seagoing merchant ships. MLC - the Maritime Labour Convention, 2006.

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1.3 The engine room layout

1.3.1 The engine room of AZI was that of a typical ship of this size, with three platform decks and a bottom deck (known as the tank top). The compressor room and no.3 auxiliary engine were located at the A-deck (aft) where the portable pump was lifted into the engine room from the main deck. The first walkway grating was at forward part of this deck.

1.3.2 The second deck in the engine room was a mid-platform B-deck (see **Figure 2**). Similar to A-deck walkway, there was a grating on B-deck walkway (located right below the A-deck grating at a height of about 4.35m). Both the A-deck and B-deck walkway gratings were opened by the Fitter and the GPT. No temporary fencing nor notices were placed to warn others of the two openings along the walkways.

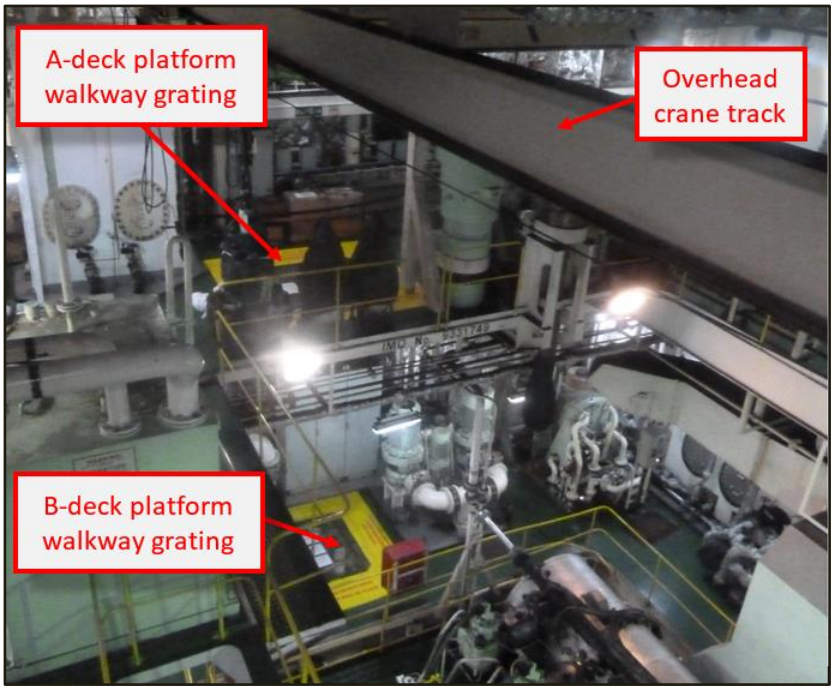

Figure 2 - Engine room forward portion layout after the occurrence (*Photo source*: National Transportation Safety Committee[16])

1.3.3 The manholes of the bilge tank and sludge tank were located at the tank top below the smaller extent of the third deck, i.e. C-deck platform. The height between the B-deck and tank top floor was about 4.9m. the total height between the A-deck platform and the tank top floor was at about 9.2m.

1.3.4 On board AZI, the engine room overhead crane's hook when not in use, was normally secured onto a spare cylinder head at the forward part of the A-

[16] The Marine Safety Investigators from the National Transportation Safety Committee, of the Republic of Indonesia, provided evidence to the investigation team when the AZI called at an Indonesian port after Nansha on 20 March 2018.

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deck platform. The walkway grating at this deck was in a close proximity. Next to this walkway grating (and opening), was a bulkhead where the remote control for the overhead crane and associated cables were stowed (see **Figure 3**).

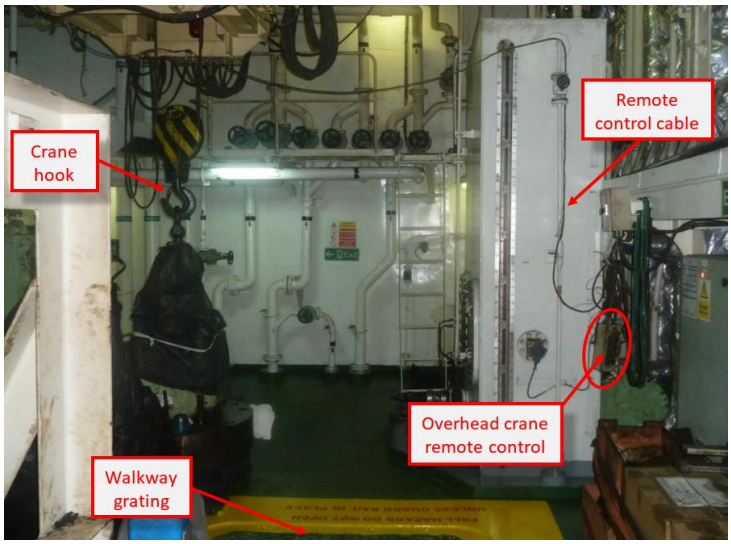

Figure 3 – A-deck platform overview
(*Photo source:* the ISM Manager)

1.4 The walkway gratings

1.4.1 The purpose of the walkway openings at A-deck and B-deck platforms was to facilitate lifting or lowering of heavy items onto different decks using the engine room overhead crane. These walkway openings were typically covered with two half-sized gratings which were normally kept closed and bolted when not in use to prevent falling of personnel. The square opening was about 1.37m (length) x 1.37m (width) (see **Figure 4**). The dimensions and design of the openings and gratings were the same at both A-deck and B-deck platform.

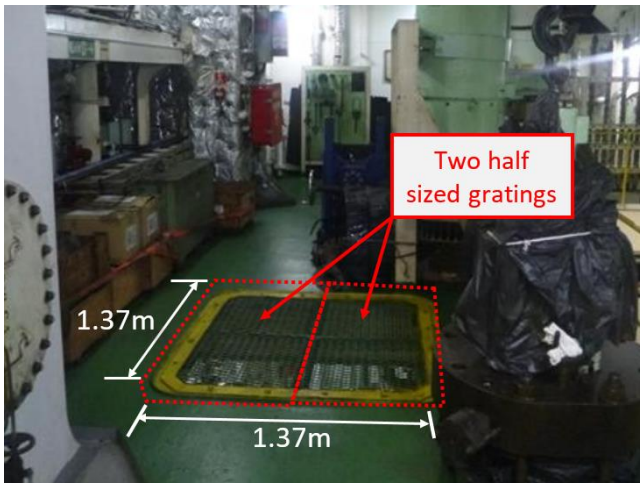

Figure 4 – Bolted grating at A-deck platform
(*Photo source:* the ISM Manager)

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1.5 The accident site

1.5.1 At the time of the accident, both the gratings (set) on A-deck and B-deck walkway openings were opened with only one-half of the gratings. The side of the grating nearer to the engine room overhead crane track was being removed and placed on top of the other grating which was still bolted.

1.5.2 At the A-deck, on one side of the walkway opening, a width of about 0.6m passage was available between a few wooden spare parts boxes and the unopened grating. On the other side, a spare main engine cylinder head was stowed along the walkway, leaving only a width of about 0.2m of passage (see **Figure 5**).

1.5.3 At the time of accident, after the gratings at A-deck and B-deck were opened, there was neither temporary fencing in place nor warning signs posted around both openings at both platform decks. There was no specific means or arrangement to guard the two openings along the walkways.

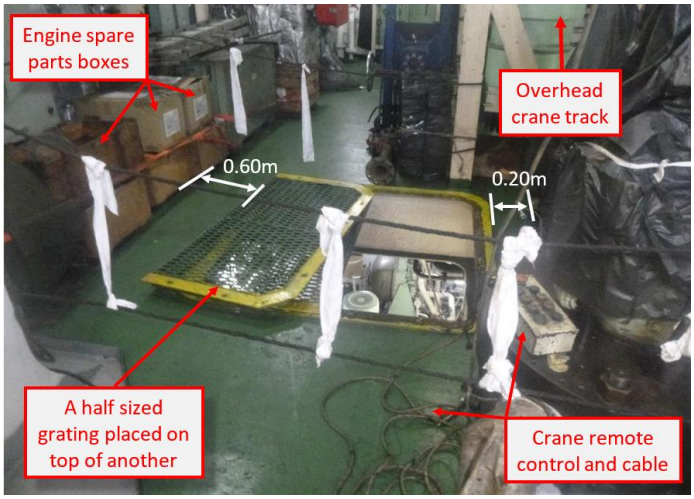

Figure 5 - View of the A-deck walkway opening and surroundings
(Note: the rope with white cloth tied as fencing was done after the accident)
(*Photo source:* the ISM Manager)

1.5.4 According to the Second Engineer and other engine crew, at the time of accident, the overhead crane remote control was not stowed at its normal location (bulkhead) and had been kept on the spare cylinder head, next to the crane hook and the cables were lying on the floor of the A-deck near the walkway grating opening.

1.5.5 The Oiler was found in a pool of blood on the tank top floor with the left side of his face towards the floor.

1.5.6 Prior to the accident, the Oiler was seen wearing his personal protective equipment comprising of a safety helmet, ear muffs and a pair of cotton

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gloves. When he was found, his safety helmet was found at a deck above, that is, B-deck platform, without any signs of crack and his ear muffs were found split into two at B-deck platform near the walkway opening. His right safety shoe had come off and was found near him. The pair of cotton gloves were still intact on his both hands.

1.5.7 There were no CCTV cameras covering the areas where the accident occurred. Evidence of how the Oiler fell was not available.

1.6 Safety Management System

1.6.1 The company managed a fleet of several types of ships, comprising of dry bulk carriers, tankers, container ships and multi-purpose carriers.

1.6.2 The Document of Compliance certificate was issued to the company by DNV-GL on 12 January 2015 based on the verification conducted on 24 October 2014. The certificate was valid until 7 December 2019.

1.6.3 The Safety Management Certificate was initially issued to AZI in 2015 by DNV-GL, and re-issued on 16 January 2018 after an intermediate audit. The certificate was valid until 4 May 2020.

1.6.4 DNV-GL also carried out an external ISM audit on AZI on 16 January 2018. The audit report raised Non-conformities with regards to shipboard operations, relating to safety drills not carried out as defined in company's procedures and the shipboard critical system and equipment not frequently maintained in accordance to the company's SMS. An Observation was also raised on the lack of housekeeping in the ship's purifier room and other areas in the engine room.

1.6.5 The company's SMS procedures required all newly joined seafarers to undergo safety familiarisation on board. The familiarisation training comprised of two parts, Part-1 covered emergency training[17] and was required to be completed before departure from the port. Part-2 covered training and instruction[18] on board, on locations of various safety equipment and systems, which was required to be completed within 2-weeks of joining. These requirements had been fulfilled on record by all crew on AZI at the time of the incident.

1.6.6 In addition to this familiarisation training, the company's SMS procedures also required ratings to be familiarised with their duties on board (GOF - 4.1d) within two weeks of joining. The scope of the training included

[17] Mandatory under regulation 19.2, Chapter III of SOLAS Convention.
[18] Mandatory under regulation 19.4, Chapter III of SOLAS Convention.

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company's policies and SMS, awareness of an open reporting system, safe working practices, use of risk assessments and knowledge of permit to work system. The Oiler, GPT and Fitter had undergone the familiarisation training.

1.6.7 Procedures for near miss[19] reporting (GOPR - 4.6) in the company's SMS required all crew members to report unsafe acts and conditions, which could become near misses, in addition to safe acts and conditions, which would form best practices. The reporting could be done in two ways, i.e. to drop a note on pre-printed Safety Observation Notes into a dedicated collection box. The second way was to report verbally to the head of the department, in this case, the Chief Engineer or his deputy, Second Engineer. On this day, there was no unsafe acts or conditions reported when the walkway gratings had been opened at A and B-deck platforms.

1.6.8 The company had developed a number of generic risk assessments[20] to guide the employees. The list of risk assessments was considered non-exhaustive and could be initialised on board by the Master for onward assignment to the person in-charge. The company's SMS procedures required a risk assessment to be initialized on the activities deviating from normal operations, standard procedures or prior to carrying out non-routine activities.

1.6.9 To do so, the first step was to identify and report hazards anticipating the intended activity to be carried out. The ship's Master would then initialise the risk assessment procedure and assign a qualified person in-charge on board for follow-up. The person in-charge could then specify the task or activity and identify the hazards, put risk control measures in place and assess the risk factors (GOPR - 4.5).

1.6.10 The opening of gratings was considered as unusual and non-routine operation on board. Prior to the occurrence, there was no safety briefing conducted on the tasks assigned by the Second Engineer (See paragraph 1.1.5) nor a risk assessment initialised although the tasks included the opening of walkway gratings.

[19] Definition in the company's SMS was a near miss or hazardous occurrence as named differently that was a sequence of events and / or conditions that could have but actually did not result in harm. The potential harm could be human injury, environmental damage or negative business impact. Examples of a near miss such as unsafe conditions, unsafe behaviours, events where injury of person could have occurred but did not, events where an unexpected condition could lead to adverse consequences but which does not occur, events where stop work authority had been used, etc.

[20] There were 75 Generic Risk Assessments developed covering operations relating to the deck, engine room, navigation, cargo handling and others. None of the Risk Assessments specifically identified fall from height as a hazard when gratings or openings on a ship's deck or platform were to be opened for maintenance and inspection

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1.6.11 The company's SMS procedures highlighted in the Safe Working Practices section that all ship's crew were encouraged to study the listed documents[21] relating to safe working practices on board.

1.6.12 A Stop Work Authority was a part of procedures in the same section. This provided the mechanism for any crew members or, subcontractors or, visitors to stop work on board where in their opinion, a safety and environment risk existed, or when a hazard was identified that presented imminent danger to the health of crew members or any other personnel (GOPR - 5.1). Any individual could initiate the stop work order and did not have to be involved in the work taking place.

1.6.13 Another section in the SMS was on Maintenance of Walkways which stated that, removable gratings must be properly secured in place, where crew members would walk over it. This section further added, where a grating was temporarily removed from a walkway, the area must be fenced off to prevent personnel from falling. Appropriate warning notices must be posted. Both safety measures were not being carried out.

1.6.14 A standard section detailing a systematic and controlled way of discharging oily mixtures (sludge) to shore reception facilities[22] was documented in the company's SMS procedures (MSOPR - 11.11). The procedure required the completion of a checklist[23] and did not require the conduct of a risk assessment. At the time of accident, the approved ship's sludge discharging pump and piping system were in good working condition. For discharging sludge using the ship's designated piping system (see section 1.8.2), walkway gratings were not required to be opened.

1.7 Relevant safe working practice

1.7.1 The COSWP[24], was to be carried on board the company's fleet of ships and incorporated into the company's SMS procedures.

[21] Four listed documents for crew to study – Procedures of the Management System, System Failure File, Training Manual and Code of Safe Working Practices for Merchant Seaman (COSWP).

[22] The ship's records indicated that the accumulated oily sludge was high and required to be discharged ashore

[23] One of the items required that prior to discharge, the ship's discharge hose, pipelines, and manifold is in good condition and properly rigged. There was no specific mention of the sludge pump in this checklist.

[24] Code of Safe Working Practices for Merchant Seafarers (COSWP) is not a mandatory publication for carriage on Singapore registered ships. The Maritime and Port Authority of Singapore (flag Administration) had issued a circular No.25 of 2017 – Carriage Onboard of Safe Working Practices Publications, indicating that, "…*For SOLAS convention ships (>500 GT), if the SMS makes reference to relevant safe working practices code/guidelines, a copy of these code/guidelines should be made available on board."* The COSWP is published by the UK Maritime and Coastguard Agency (MCA) provides best practice and guidance for improving health and safety on board ships.

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1.7.2 Chapter 1.2.4 of COSWP - Managing Occupational Health and Safety - Planning of work is essential in ensuring occupational health and safety at work. Adequate control of risks can only be achieved by ensuring that all involved are aware, activities are coordinated and good communication is maintained by all involved.

1.7.3 While planning the task, consideration of what actions are necessary, how these will be carried out and what effect they may have on seafarers' safety at work, taking into account that there may be consequences that are indirect and unintended.

1.7.4 Chapter 1.2.5 on risk awareness, highlights that, seafarer's knowledge about risk can be attained through a combination of conducting risk assessment, theoretical training, practical application, information sharing, personal experience, as well as clear instructions and supervision by supervisors.

1.7.5 Chapter 9 (Safety signs and their use) further provides guidelines on safety signs including hazard warnings used to indicate hazards, where the hazard cannot be removed.

1.7.6 The guidelines also require the company to ensure clearly understandable safety signs are displayed where appropriate on board ships.

1.7.7 Chapter 11.6 (Guarding of openings) provides guidelines on general requirements on the openings for handling cargo or stores, through which persons may fall or on which they may trip, should be closed as soon as work stops.

1.7.8 The guardrails or fencing for the openings should be properly maintained. Each course of rails should be kept substantially horizontal and taut throughout their length.

1.8 Means of sludge disposal

1.8.1 According to AZI's accident report, the portable pump brought on board from the sludge barge was understood to be of a higher discharging capacity compared to ship's fixed sludge transfer system (10m^3 per hour). The actual discharge rate of the portable pump was not known or recorded in ship's log.

1.8.2 The MARPOL Convention, Annex I, Regulation 12[25] requires that, ship with 400 gross tonnage and above are to dispose its oil residues directly from

[25] Regulation 12 - Tanks for oil residues (sludge).

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the sludge tank(s) through the standard discharge connection[26] or any other approved means of disposal which AZI applies.

1.8.3 According to AZI's Form A of the IOPP[27] certificate issued by Bureau Veritas on 10 August 2017 which was valid till 9 August 2022, confirmed that AZI was installed with a pipeline for the discharge of residues from machinery bilges and sludge to reception facilities, and fitted with a standard discharge connection in accordance with regulation 13 of the MARPOL. No other approved means for the sludge disposal was stated in this form other than incineration by ship's incinerator.

1.8.4 According to the Flag Administration of AZI, the use of a portable pump to facilitate the sludge transfer from the ship's engine room sludge tanks to a sludge barge, is not considered as approved means. Such discharge should, at all times, be using fixed sludge transfer pump, fixed piping and standard discharge connection. Prior to the accident, the Flag Administration did not receive any information of faulty ship's fixed piping system for sludge discharge from the AZI.

1.8.5 The company too, was not aware that the sludge was being planned to be disposed using a portable pump. The Chief Engineer and Second Engineer accepted the offer made by the sludge barge crew, and the Master of AZI was made known of this arrangement only after the accident.

1.9 Medical report

1.9.1 There was no autopsy carried out for the Oiler. A death certificate was issued upon his demise.

1.9.2 The death certificate noted the cause of death was due to serious head injuries.

1.10 Environmental condition

1.10.1 At the time of the accident, the weather was fair with partly cloudy sky and the sea was calm.

1.10.2 The engine room working environment was normal, the main engine was off. The ambient engine room temperature was about 24 degrees Celsius. Shipboard lighting was typical and considered sufficient for routine work in the engine room.

[26] Regulation 13 – Standard discharge connection.

[27] The Form A of the International Oil Pollution Prevention Certificate provides records of construction and equipment for ships other than oil tankers.

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2 ANALYSIS

2.1 The cause of fall

2.1.1 There were no indications of the Oiler being / reported unwell prior to the occurrence. The investigation team could not establish if the Oiler's medical condition played a part in this occurrence (see footnote 12).

2.1.2 In the absence of a witness account, the investigation team looked at evidence from the post-accident site to assess the likely location / cause of the Oiler's fall.

2.1.3 The period between when the Oiler left the team members till he was seen lying on the engine room bottom deck floor was about 10 minutes. The Oiler had very likely on his own accord gone to prepare for the next step, i.e. to get the overhead crane ready for use. The preparation included getting the crane remote control which was not in its normal position and the cables were lying near the partially opened grating at the A-deck platform.

2.1.4 After viewing the location of the Oiler's safety helmet and ear muffs, the investigation team was of the view that it was thus very likely that the Oiler fell through the partially opened grating on A-deck, falling past the opening on B-deck and landing onto the tank top. A fall from a height of more than 9m would have resulted in serious head injuries. The cause of his fall could not be established with certainty, but a slip, trip, walking into the opening in a rush or a fall due to a medical event[28] could not be ruled out.

2.2 Task planning and risk assessment

2.2.1 The discharge of the sludge was brought forward to a day earlier and within 15mins of the change, the sludge barge arrived at AZI's location. In addition, a non-standard sludge disposal method was accepted and in a short span of time the ship's crew had likely not carried proper planning for the discharge of sludge.

2.2.2 When the Master accepted the early sludge disposal, though he checked with the Chief Engineer on the possibility of commencing sludge discharge earlier than planned, he was not aware that the walkway gratings in the engine room were to be opened. There was also no evidence showing detailed discussion on the operation, safety considerations and whether compliance with MARPOL requirements was being carried out.

[28] Although Hypertension is a chronic condition, if the blood pressure rises quickly and severely, it can result in a medical emergency requiring immediate treatment. In such a situation, it can cause a stroke or heart attack.

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2.2.3 When the sludge barge offered a portable pump to the ship's crew for carrying out the discharge, the in-situ and unapproved arrangement was accepted by the Chief Engineer.

2.2.4 Proper task planning for shipboard activities is essential to ensure safety at work as highlighted in COSWP. In accordance with the company's procedures, non-routine activities, such as opening of walkway gratings required a risk assessment to be initialised. Despite the company's SMS for a risk assessment to be carried out for unusual and non-routine operations on board, there was no risk assessment carried out by the Master or the person in-charge (in this case, the Second Engineer) when it was decided to open the walkway gratings for facilitating the transfer of an equipment.

2.2.5 None of the engineering crew involved in the transferring of the portable pump raised concerns for the lack of risk assessment, unauthorised use of portable pump and lack of temporary fencing or warning notices at the walkway gratings.

2.2.6 There is also a likelihood that instructions were given to the engineering crew on the tasks to be carried out with the expectation to assess the risks involved based on their own understanding.

2.2.7 The relatively narrow side clearances (0.6m and 0.2m) near the walkway opening gratings at A-deck (refer to para 1.53) would be considered a risky working environment. Personnel working in or in the close vicinity of such a location could slip or trip and lose their balance and fall through the opening of 1.37m x 0.68m which is considered large enough for an adult.

2.2.8 While it is inevitable the shipboard operation could be rescheduled due to unforeseen circumstances, proper planning of tasks and risk assessment must still be carried out to ensure the safety of crew on board. In this occurrence, putting appropriate control measures such as temporary fencing arrangements and placing warning signs would have been able to mitigate this risk of falling from height.

2.3 Communication among team members

2.3.1 The incident also highlighted a lack of communication among the team members as evident by the following:

- The Fitter and the GPT did not inform the Second Engineer that the opened gratings were not setup with a temporary fencing. If they had

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done so, the Second Engineer might have required the opened grating to be fenced up.

- The Oiler didn't inform his team members of his intention when he moved away from the team to A-Deck platform. If he had done so, the Fitter or the GPT might have cautioned him of the opened gratings and taken the necessary precautions.
- The GPT did not inform his team members and moved away to the forward part of the A-deck platform when he saw something fall from the grating. He could have fallen into the grating, like the Oiler, without anyone knowing about it.

2.4 The company's Safety Management System

2.4.1 The company's SMS procedures were comprehensive and covered most shipboard operations.

2.4.2 Although the SMS procedures clearly indicated it was the Master's responsibility to initialise a risk assessment on board, there was no meeting held with the Master to determine whether a risk assessment was to be conducted considering that walkway gratings would be opened for transferring an equipment. Regardless of the conduct of a risk assessment, the open gratings in the walkway clearly posed a hazard to safety of personnel and should have been mitigated by placing appropriate safeguards in place.

2.4.3 Though the Fitter, GPT and Oiler had undergone familiarisation training on record, it could not be established why they did not consider an opening in the walkway as a potential hazard or unsafe condition that would have been expected to be reported in accordance with GOPR - 4.6. When assigning the tasks, the Second Engineer should have anticipated the unsafe conditions once the walkway gratings were opened. It was also evident that none of the personnel in the engine room exercised the Stop Work Authority.

2.4.4 Although the Chief Officer was designated as the Safety Officer on board, he was not involved in the planning of the sludge disposal operation in the engine room. The company's SMS was not clear on who would perform the role of a safety officer participating in risk management activities in such a scenario. It would have been desirable for a back-up safety officer role to be assigned for activities in the engine room. It was evident that the company's SMS requirements were ineffective in some areas.

2.4.5 The non-compliance to SMS procedures indicated that there were signs of a weak safety culture on board the ship. It would also be desirable for the

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SMS to provide better clarity on the involvement of a safety officer and the initialisation of a risk assessment.

2.5 Means of sludge disposal

2.5.1 Despite an approved standard discharge connection system on AZI, the Chief Engineer accepted the offer by the sludge barge of using a higher capacity portable pump to discharge the ship's sludge, which was not an approved means.

2.5.2 Using of an unapproved means for ship's sludge discharge posed a risk of polluting the environment, and also added other safety risk to the crew members involved such as manual transfer of the heavy portable pump.

2.5.3 Although this accident was not directly caused by the portable pump, it occurred during the process of preparing the portable pump for the sludge discharge operation which required the opening of both platform walkway gratings.

2.5.4 The company's SMS implied the use of ship's designated piping system for sludge disposal, but specifically did not prohibit the use of a portable pump for such a transfer.

2.6 Incidental observations

2.6.1 The purpose of a walkway was to facilitate easy passage of personnel and moving of equipment or stores and not meant for storage of stores or equipment. Having the wooden boxes and a spare main engine cylinder head placed on both sides of the walkway opening had reduced the clearance of the passage. The passage would be further reduced when the grating was opened and left with little space at the sides for safe working in that area. Hence, it would be desirable to keep the walkway clear of obstacles and to have proper place for the storage of spares and equipment.

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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 walkway opening covered by gratings in the engine room of AZI at A-deck and B-deck platforms were left partially open without any fencing arrangements and warning notices in the vicinity of the openings. It was likely that the Oiler had fallen from the walkway opening at A-deck, through the opening at B-deck and landing onto the tank top.

3.2 With the sludge disposal being brought forward for a day earlier, in a short span of time, there was no proper planning being carried for this operation.

3.3 The ship accepted the portable pump offered by the crew of the sludge barge for the disposal of sludge, which was not an approved means of sludge disposal.

3.4 There was lack of communication amongst the team members to ensure safety of the crew.

3.5 The company's SMS procedures were not effectively implemented on board. There was no identification of hazards related to open walkway gratings when the tasks were assigned.

3.6 The company's SMS was not clear on who would perform the role of a safety officer for risk management activities in the engine room.

3.7 The sides of the walkway next to the grating were stored with wooden boxes and spare engine cylinder which made the space smaller when the grating was removed.

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4 SAFETY ACTIONS

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

4.1 Actions taken by the ISM Manager

4.1.1 A Safety Alert was sent to all ships' Masters and Chief Engineers in its fleet to assess their engine room layout on the similarities of the design of the walkway grating opening and feedback the safety measures to the company.

4.1.2 The company amended their SMS to prohibit the use of portable pumps for ship's sludge disposal after another Safety Alert was issued to its fleet of ships on 30 May 2018. Any such request from sludge receiving parties should be rejected and ship's Masters are required to report to the company accordingly.

4.1.3 The findings and lessons learned from this occurrence were shared by the company with its fleet of ships. All Masters are required to conduct a shipboard safety meeting to enhance the crew's awareness of the walkway opening hazards.

4.1.4 A Safe Movement safety campaign was promulgated to its fleet of ships in the second quarter of 2018. The objective of the campaign was to set out appropriate standards to ensure that anyone could move safely to any place on board a ship.

4.1.5 A fleet-wide Fall Hazard Identification Project was carried out to identify and address fall hazards in its fleet of ships (see **Figure 6**).

Figure 6 - Fall hazard warnings marked at various access openings

(*Photo source:* the ISM Manager)

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5 SAFETY RECOMMENDATIONS

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

5.1 Columbia Shipmanagement (Singapore) Pte Ltd (the ISM Manager)

5.1.1 To review its process to ensure better communication among the crew members when performing shipboard operations. **[TSIB-RM-2019-015]**

5.1.2 To review its process to ensure that proper tasks planning and risk assessment are carried out on board its fleet of ships as per its SMS procedures. **[TSIB-RM-2019-016]**

5.1.3 To review the SMS procedures for better clarity so that the person in-charge of an operation could initialise a risk assessment. **[TSIB-RM-2019-017]**

5.1.4 To review the SMS procedures for better clarity on who would perform the role of a Safety Officer for risk management activities in the engine room. **[TSIB-RM-2019-018]**

-End of Report-

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