Marine Safety Investigation Unit

Transport Malta

SAFETY INVESTIGATION REPORT

202006/040 REPORT NO.: 15/2021 June 2021

MV *IOLCOS UNITY*

Fatal injury to a crew member in Aratu, Brazil 28 June 2020

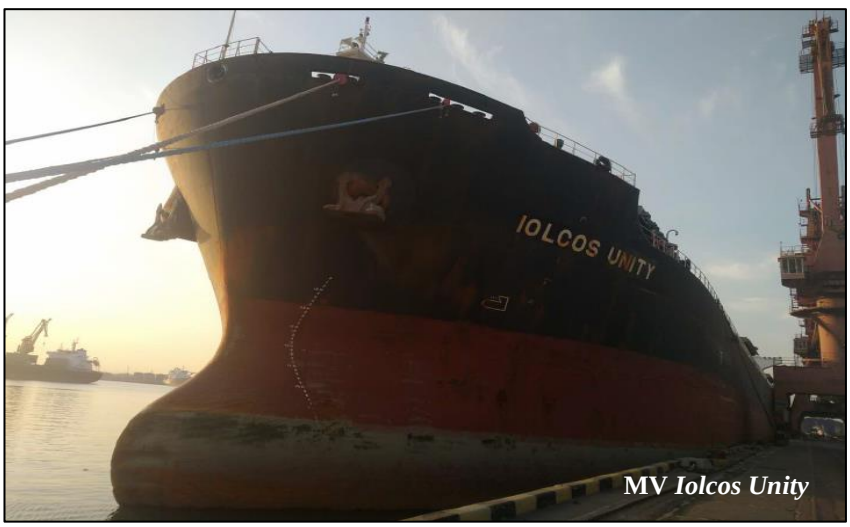
SUMMARY

In the early hours of 28 June 2020, one of the fitters on board bulk carrier *Iolcos Unity* was instructed to investigate a hydraulic oil leak on one of the ballast valves on the main deck.

Crawling to gain access to the leaking flange, the fitter's overall was permeated with hydraulic oil. While using an angle grinder to cut the bolts, sparks generated by the grinder ignited his overall. The fire spread fast, covering his upper body, neck and hands.

The fitter was evacuated to the ship's hospital and later transferred by ambulance to a local hospital for burn injuries. The fitter eventually passed away on 08 July 2020 following medical complications.

One recommendation was made to the Company, aimed at enhancing the safe use of angle grinders on board.



MV *Iolcos Unity*

FACTUAL INFORMATION

Vessel

Iolcos Unity, a 40,485 gt dry bulk cargo vessel was built in 2006 and registered in Malta. She was owned by Hudson Anthem Shipping Company Limited, managed by Iolcos Hellenic Maritime Enterprises Co. Ltd., and classed with Nippon Kaiji Kyokai (NKK).

The vessel had a length overall of 225 m. *Iolcos Unity* was fitted with seven cargo holds and had a deadweight of 74,476 tonnes. Propulsive power was provided by a five-cylinder HHM MAN-B&W 5S60MC-C Mk7 diesel engine, producing 8,990 kW at 92 rpm. This drove a single, fixed pitch propeller, enabling the vessel to reach a service speed of 13.80 knots.

Ship's crew

Iolcos Unity was manned with a crew of Ukrainian and Filipino nationals. The manning was in excess of the number stipulated in the Minimum Safe Manning Certificate issued by the flag State Administration.

The chief officer, who was carrying out ballast operations at the time of the accident, was a 52-year-old Ukraine national. He held a valid Certificate of Competency issued in terms of STCW regulation II/2 and IV/2 by the Government of Ukraine. He had been working with the Company as chief officer for the past 10 years. He joined *Iolcos Unity* on 30 December 2019.

The Filipino bosun was 41 years old with 29 years of seafaring experience. He held an STCW II/5 (able seafarer deck) certificate at support level. He had joined the vessel on 02 December 2019.

The injured Ukrainian fitter was 45 years old and had been working at sea for 20 years. He held a Certificate of Proficiency as ship's welder. In 2019, he was issued with a Welder-Approval Test Certificate by Bureau Veritas International Register of Surveyors.

He had joined *Iolcos Unity* on 15 November 2019 in Port Cartier, Canada. In accordance with section 6 of the IMO Resolution A. 741(18) and vessel's safety management system (SMS), he had undertaken familiarisation and instructions upon joining the vessel. On board *Iolcos Unity*, he had non-watchkeeping duties between 0700 and 1800.

Environmental conditions

The weather was clear with visibility up to four nautical miles. There was a Southwesterly light breeze. The sea was calm, and the air temperature was 27 °C.

Narrative[1]

On 28 June 2020, *Iolcos Unity* was berthed at TPC pier, Aratu, Brazil, loading cargo. The chief officer was carrying out ballast operations.

At about 0245, hydraulic oil was noticed leaking from a flange fitted on the hydraulic line, which operated the ballast line valves (Figure 2).

Figure 2: Photo showing location of the flange (photo taken after the repairs had been completed).

[1] Unless otherwise stated, all times are local times (UTC -3).

The flange was fitted on the main deck starboard side between cargo holds nos. 5 and 6. The chief officer immediately stopped the ballast operations, closed the valve, and depressurised the hydraulic line. Along with the bosun, several crew members mopped up the oil and removed it to the forecastle store.

Following the clean-up operation, the chief officer called the ship's two fitters to repair the leaking flange. Risks were assessed and a tool-box talk was also organised. Prior to carrying out the repairs, a permit for cold work was issued by the chief officer and signed by the fitters.

The repair job was initiated soon after. One of the fitters knelt to take out the flange's bolts using a spanner. However, due to accumulating rust and worn-out hexagon head, the bolts were intractable. He therefore opted to use a portable angle grinder and cut the bolts.

A few minutes later, while still using the grinder, at about 0330, the fitter's overall caught fire from the metal sparks generated by the grinder. Instantly, the fire spread all over, burning his legs, neck, upper body and hands. The fire was quickly extinguished, and the injured fitter was assisted to the ship's hospital.

In the meantime, the master was informed of the accident who immediately informed the Company. The local agent was asked to arrange for an ambulance. Meanwhile, the master administered first aid and an injection of morphine to ease the pain and trauma. The fitter was transferred to the shore hospital several hours later.

Medical treatment and care

The fitter was admitted in the hospital's intensive care unit (ICU). He had burn injuries to over 40 percent of the body surface but was responding well to the treatment. A few days later, he was declared clinically stable and shifted to the hospital's high complexity unit. However, in the evening of 07 July, the fitter was re-admitted to the ICU due to complications arising from an infection. The sudden onset and severity of the infection caused by the burns was such that a few hours later, at 0030 on 08 July 2020, he was pronounced death.

Properties of the hydraulic oil

The product name of the hydraulic oil in use on board *Iolcos Unity* was Mobil DTE 10 Excel 32. The oil, which had a flash point of ≥200 °C, was described as high-performance, anti-wear hydraulic oil, for use in high pressure industrial and mobile equipment. Mobil DTE 10 Excel 32 was produced from selected base oils and proprietary additive system. No skin protection was ordinarily required under normal conditions of use. The material safety data sheet (MSDS), however, listed aldehydes, oxides of carbon, sulphur oxides, and smoke fume as hazards in the event of combustion of Mobil DTE 10.

Permit to work and PPE

Iolcos Unity's safety management system provided guidance on the permit to work system and personal protective equipment (PPE) to avoid accidents and injuries. Accordingly, the fitter had donned PPE and the chief officer prepared a permit for cold work on the hydraulic pipe flange. Although, the Company had supplied the vessel with 100% Sanforized cotton overalls[2], the fitter at the time of the accident, was reportedly wearing a synthetic overall[3].

[2] Process of treating cotton fabrics against shrinkage that would otherwise occur after the first wash.

[3] The working overall worn by the fitter was not preserved on board.

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.

Fatigue

The injured fitter had been engaged on day work, doing a non-watchkeeping duty of 10 hours. His hours of rest document showed 14 hours of rest in a 24-hour period, and 108 hours in the previous seven-day period. In the absence of fatigue-related behaviour, fatigue was not considered a contributory cause to this accident.

Probable cause of the accident

The available information suggested that the position of the repair site necessitated the crew member doing the repairs to kneel to access the flange (Figure 3).

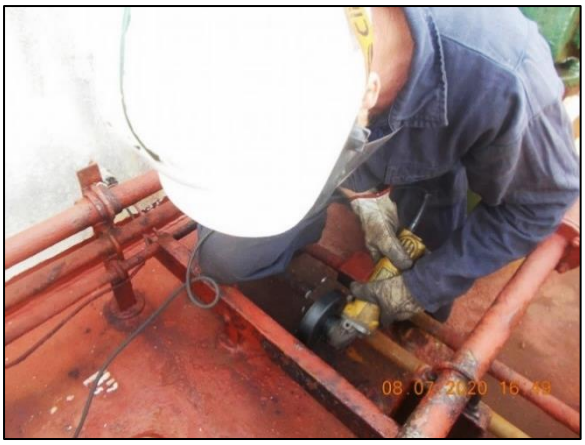


Figure 3: Simulated photo showing crew operating portable angle grinder on leaking flange.

In that position, the fitter's overall would have been permeated with hydraulic oil, collected under the leaking pipe. The fitter struggled to release the nuts and bolts and therefore resorted to use the portable angle grinder. The site was deemed hazard free and no specific tool for the job had been indicated in the work permit. Moreover, considering the tight working area, an angle grinder would have been the most ideal tool to use in the circumstances.

It is evident that the change in the use of tools was not questioned by other crew members. One of the issues which the safety investigation analysed was the use of the angle grinder in the proximity of (flammable) hydraulic oil, given that there was no doubt that the fitter must have been aware that hydraulic oil was flammable.

Academic research indicated that there is a tendency to assume that a person has knowledge, is expected to make use of that knowledge in any circumstance. However, this is not necessarily always the case. Studies have identified circumstances where knowledge may be accessed in one setting but not in others. This is known as 'inert knowledge'.

It was not excluded that the fitter would have known about the (incompatible) relationships between hydraulic oil and an ignition source, but that knowledge had not been activated when the ignition source was flying sparks from an angle grinder. The safety investigation was of the view that the risk had not been recognised because the fitter did not see its detail; also given that his goal was the freeing of the bolts and nuts on the flange, and this was a job which had to be done.

The metal sparks generated by the angle grinder ignited the fitter's overall, and the oil-contaminated synthetic fabric rapidly increased the burning rate[4]. While the physical and chemical hazards of burnt hydraulic oil on burn injuries could not be precisely known, its probability of causing

[4] Fardell, P., & Rock, C. (2004). *Tests for the ignition and flame spread of clothing fabrics subjected to angle grinder sparks: Research Report 222*. Retrieved from https://www.hse.gov.uk/research/rrpdf/rr222.pdf

medical complications could not be ruled out by the safety investigation.

Previous investigated accidents involving portable angle grinder

This was not the first occurrence which the MSIU investigated following an injury cause by an angle grinder. One serious injury investigated by the MSIU involved the use of an angle grinder to cut a hole in laminated panels to gain access to a faulty, bridge window, wiper electrical motor. The access area was limited, and the crew member had to crouch while operating the grinder. On exiting the area, the crew member inadvertently touched the rotating cutting disc and sustained a deep laceration of his right arm and wrist[5].

CONCLUSIONS

1. It is highly probable that metal sparks generated by the angle grinder ignited the fitter's overall and the oil-contaminated synthetic fabric rapidly increased the burning rate.
2. It was not excluded that the fitter would have known about the (incompatible) relationships between hydraulic oil and an ignition source, but that knowledge had not been activated when the ignition source was flying sparks from an angle grinder.
3. Permit to repair the leaking flange indicated repair site free from hazard and for cold work only.
4. Hydraulic oil Mobil DTE 10 had a flash point of ≥200 °C. The MSDS suggested precautionary measures to avoid contact with spilled material and listed several hazards resulting from the combustion of Mobil DTE 10.
5. Prior authorization and dynamic risk assessment to use a portable angle grinder were not considered.

SAFETY ACTIONS TAKEN DURING THE COURSE OF THE SAFETY INVESTIGATION[6]

The Company carried out an internal investigation in accordance with Section 9 of the ISM Code. The findings of the internal investigation were discussed during an extraordinary meeting. Moreover, relevant Company procedures and risk assessments were reviewed to implement the necessary controls and procedures and avoid a reoccurrence of this accident.

The following corrective / preventive actions were adopted by the Company:

- communicated instructions with fleet vessels, to hold an extra safety committee meeting, discuss the events of the incident, carry out a thorough and detailed inspection of safety and fire-fighting equipment, rectify deficiencies and refresh familiarisation / training on Company's established safe working procedures and permit system in conjunction with the principles of the 'Stop Work Authority';
- forwarded full analysis and the lessons learnt from this accident to all fleet vessels, with instructions to discuss with officers and ratings at the Safety Committee Meeting on board;
- issued a Fleet Safety Circular, highlighting the importance of following procedures and policies, and requesting masters to ensure that all shipboard personnel is aware and familiarised with its contents;

[5] *Vide* MSIU Safety Investigation Report No. 18/2015.

[6] **Safety actions and recommendations shall not create a presumption of blame and / or liability.**

- initiated a behaviour-based safety programme to identify and mitigate unsafe behaviour in a timely manner and launched a safety campaign on 'Safety Culture and Stop Work Authority'.

RECOMMENDATIONS

Iolcos Unity's managers are recommended to:

15/2021_R1 Amend SMS procedures on the use of portable angle grinders, and include portable angle grinding as a hot work activity.

SHIP PARTICULARS

Vessel Name:	*Iolcos Unity*
Flag:	Malta
Classification Society:	NKK
IMO Number:	9313058
Type:	Bulk carrier
Registered Owner:	Hudson Anthem Shipping Company Limited
Managers:	Iolcos Hellenic Maritime Enterprises Co., Ltd
Construction:	Steel
Length Overall:	225.00 m
Registered Length:	218.22 m
Gross Tonnage:	40,485
Minimum Safe Manning:	14
Authorised Cargo:	Dry bulk

VOYAGE PARTICULARS

Port of Departure:	Lisbon, Portugal
Port of Arrival:	Aratu, Brazil
Type of Voyage:	International
Cargo Information:	In ballast
Manning:	28

MARINE OCCURRENCE INFORMATION

Date and Time:	28 June 2020 at 0330 (LT)
Classification of Occurrence:	Serious Marine Casualty
Location of Occurrence:	Aratu, Brazil
Place on Board	Main deck
Injuries / Fatalities:	One fatality
Damage / Environmental Impact:	None
Ship Operation:	Loading
Voyage Segment:	Alongside
External & Internal Environment:	Clear weather with visibility up to four nautical miles and Southwesterly light breeze. Sea was calm and the air temperature was 27 °C.
Persons on board:	28