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AUSTRALIAN TRANSPORT SAFETY INVESTIGATION REPORT
Marine Occurrence Investigation No. 244

Crew member fatality on board *Oceanic Angel*

At about 1640[1] on 8 August 2007, an able seaman died on board the bulk carrier *Oceanic Angel* as a result of a fall from the forward ladder in the ship's number three cargo hold. The seaman had been part of a team preparing the hold for an upcoming cargo and had just finished work for the day.

Oceanic Angel

Oceanic Angel (Figure 1) is a conventional, geared bulk carrier. It has five cargo holds and four cargo cranes, all located forward of the accommodation superstructure.

The ship was built in 1998 by Mitsui Engineering and Shipbuilding, Japan. It has an overall length of 189.8 m, a moulded breadth of 31.0 m and a moulded depth of 16.5 m. At its summer draught of 11.62 m, the ship has a deadweight of 46 677 tonnes.

At the time of the accident, *Oceanic Angel* was registered in Panama, owned by Sea Train Maritime, Panama, managed by Dojima Marine, Japan and classed with ClassNK.

The ship's propulsive power is provided by a single Mitsui MAN B&W 6S50MC single acting, direct reversing, two-stroke diesel engine. The engine develops 10 100 kW at 111 rpm and drives a fixed pitch propeller. The ship has a service speed of about 14.5 knots[2].

At the time of the accident, *Oceanic Angel* had a crew of 20 Filipino nationals.

The master had 31 years of seagoing experience. He held a master's certificate of competency that was issued in the Philippines. He had been sailing as master for about seven years and, at the time of the accident, had been on board *Oceanic Angel* for about 23 months.

The chief mate had nine years of seagoing experience. He held a chief mate's certificate of competency that had been issued in the Philippines. He had joined *Oceanic Angel* as second mate in April 2006 and, in January 2007

Figure 1: *Oceanic Angel*

1 All times referred to in this report are local time.

2 One knot, or one nautical mile per hour, equals 1.852 kilometres per hour.

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was promoted to chief mate. In all, he had been on board the ship for 16 months.

The deceased able seaman was 47 years of age and, according to the ship's master, was a very experienced seafarer. At the time of the accident, he had been on board *Oceanic Angel* for about 14 months.

Cargo hold preparation

The first stage in preparing the cargo holds for the upcoming salt cargo involved the crew opening the hatch covers and using a small air driven diaphragm pump, connected to a hose and nozzle, to spray the surfaces of each hold with hydrochloric acid. The acid was used to remove rust from the steel bulkheads and frames inside the cargo holds.

The acid was then left for a period of time before being washed off with seawater.

The next step was to spray the hold surfaces with a diluted solution of 'Aquatuff', an alkaline tank cleaner. The purpose of the Aquatuff was to clean the surfaces and to neutralise any remaining acid. The Aquatuff was then left for a period of time before being washed off with fresh water.

The final step in the process was to lime wash the holds in readiness for loading the salt.

Hydrochloric acid

Hydrochloric acid is the aqueous solution of hydrogen chloride gas.

According to the product quality certificate provided by the ship's manager, the acid being used on board *Oceanic Angel* was a 31% solution of hydrochloric acid in water.

In high concentrations hydrochloric acid can form a mist. Both the mist and the solution have a corrosive effect on human tissue, potentially damaging respiratory organs, eyes, skin and intestines. Chronic overexposure to hydrochloric acid can cause dizziness, headaches and respiratory difficulties.

Appropriate precautions should be taken to minimise these effects while working with hydrochloric acid. These precautions include wearing rubber or polyvinyl chloride (PVC) gloves, protective eye goggles, a respirator and chemical resistant clothing.

The accident

On 6 August 2007, *Oceanic Angel* sailed from Tuticorin, India bound for Dampier, Australia. During the voyage, the ship's crew completed their normal watchkeeping routines, carried out a number of maintenance tasks and prepared the cargo holds for the upcoming salt cargo.

At 0800 on 8 August, the crew continued preparing the cargo holds. The ship was about three degrees south of the equator and there were occasional passing showers of rain. At noon, the outside air temperature was recorded in the bridge log book as 29° C. The wind, southwest at 17 to 21 knots, was on the ship's beam and there was a sea of about two metres. The ship was moving slightly in the prevailing conditions.

By lunchtime, the crew had finished preparing number one hold and were part way through preparing number two hold.

After lunch, the crew continued working in number two hold and, when they were nearly finished, two seamen started working in number three hold. They were wearing wet weather jackets and pants over their normal working gear, sea-boots, hard hats, full face masks/respirators and nitrile rubber gloves.

At about 1515, they started spraying the dirty areas at the aft end of the hold with the acid. They then moved forward along the port side of the hold.

At about 1630, when the two men had progressed about half way along the port side of the hold, they stopped work for the day.

One of the seamen made his way to the cargo hold's aft ladder and started climbing out of the hold, while the other went to the forward ladder (Figure 2) to do likewise.

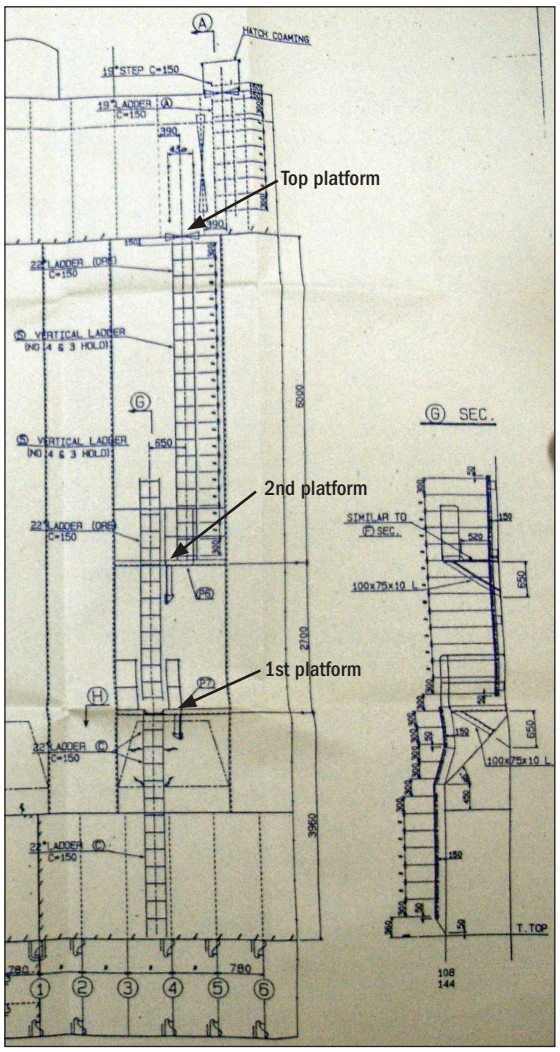
When the seaman on the aft ladder was almost at the ladder's top platform, he heard a 'loud thump'. When he turned around, he saw his colleague lying on the tank top. He then climbed out of the hold and called the bridge on his hand held radio and told the chief mate what he had seen.

The chief mate made a public address announcement and, when the master came to the bridge, went down to the deck to further investigate what had happened.

He organised the crew to get a self contained breathing apparatus, which he donned before climbing down into the cargo hold to check on

the seaman's condition. One of the seamen donned an emergency escape breathing device and followed the chief mate down the number three cargo hold aft ladder.

Figure 2: No. 3 cargo hold forward ladder



The two men examined the seaman. He was lying on his side, slumped forward with his head facing downwards. The chief mate could not find a pulse and it appeared to him that the seaman had sustained a severe head injury.

The chief mate called the master on his hand held radio and told him what he had found.

At 1643, the master reported the accident to the ship's manager, who told him to contact the appropriate rescue coordination centre (RCC) for assistance.

At 1717, the master called RCC Sri Lanka, who, in turn, asked him to call RCC Australia.

At 1800, the master called RCC Australia and was connected to a doctor. After a short conversation, the doctor confirmed that the seaman was deceased.

The crew removed the deceased seaman from the cargo hold and, as instructed by the doctor, wrapped him in plastic before placing him in an empty freezer.

The ship continued on its intended voyage and on 15 August anchored off Dampier.

At 2055 on 17 August, a pilot boarded *Oceanic Angel* for the transit from the anchorage to the Mistaken Island Salt Wharf. By 2330, the ship was all fast alongside the wharf.

The local police boarded the ship on its arrival at Mistaken Island and the deceased seaman was taken ashore.

Analysis

The accident

No one saw the seaman fall from the forward ladder in number three cargo hold. However, the man he had been working with confirmed that the seaman was exiting the hold via that ladder at the time. He also heard the 'thump' when his colleague landed on the tank top.

The post mortem examination report found that the seaman died as a result of a severe head injury.

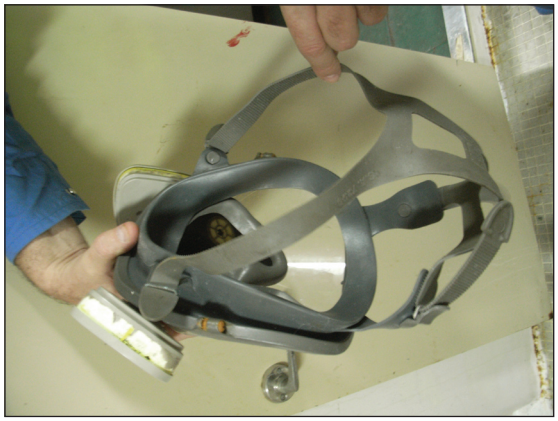
The ladder was in good condition and there was no evidence found on board the ship to suggest anything other than that the seaman slipped and fell from the cargo hold ladder.

The forward and aft cargo hold ladders were constructed differently. The middle section of the aft cargo hold ladder was an inclined staircase and, hence, probably easier to climb. However, no one on board the ship knew why the deceased seaman decided to exit the hold via the forward ladder.

The seaman who exited the hold via the aft ladder was wearing all of his personal protective equipment (PPE) and was almost at the top platform of the ladder when he heard the 'thump'. The two hold ladders were equi-distant from where the two seamen had finished working. Therefore, if the deceased seaman had not been delayed, he probably would have been near the top platform of the forward ladder when he fell, a height of about 11.7 m.

The seaman was not wearing his face mask when he was found. The mask was found on the first platform of the ladder, about four metres above the tank top, and its securing straps had been deliberately released (Figure 3). It is likely that the seaman had removed the mask either before climbing the ladder, or while on one of the ladder's platforms. The action of removing the mask would, almost certainly, have delayed his exit from the cargo hold.

Figure 3: Respirator/face mask



Therefore, the seaman probably reached a height on the ladder that was beyond the first platform (Figure 2), where the face mask was found, but lower than the top platform, the height that the other seaman had reached.

The seaman's undamaged hard hat was found about 20 m from where the seaman was found. The hat was fitted with a chin strap but it seems unlikely that the seaman had refitted it under his chin after he removed it in order to remove his face mask. The hat then probably slipped off his head as he fell from the ladder.

At about 1640 on 8 August 2007, the seaman probably slipped and fell from the cargo hold ladder at a height of in excess of four metres. It is likely that he was not wearing his face mask at the time and that his hard hat was not fitted with the chin strap in place to secure it.

Local conditions

There are a number of factors that may have increased the difficulty that the seaman experienced while climbing the cargo hold ladder.

Fatigue

The deceased seaman had been assigned to the twelve to four watch. This meant that while the ship was at sea, he was the bridge lookout from 0000 to 0400 and 1200 to 1600 each day. However, it was normal practice for the lookouts to assist with deck maintenance during daylight hours and to complete about two hours of overtime each day.

On each of the days since the ship had departed from Tuticorin, the seaman had completed his lookout duties between 0000 and 0400 and assisted with cleaning the cargo holds between 1000 and 1700. His working hours met the requirements of STCW 95[3] and an analysis of his working hours/rest periods indicates that if he had been sleeping reasonably well he may not have been significantly fatigued at 1640 on 8 August.

However, he had been carrying out an arduous task in tropical weather conditions while wearing wet weather clothing, gloves, boots and a face mask.

It is likely that, at the end of a hot, humid and arduous day, the seaman was tired and his attention may not have been fully focused on the task of climbing the cargo hold ladder.

Personal protective equipment (PPE)

The seaman was wearing nitrile rubber gloves when he was found. The gloves may have provided his hands with some protection as he climbed the ladder. However, in the tropical heat, his hands would have been wet with perspiration and it is possible that they were slipping within the gloves as he was climbing the ladder.

He was also wearing sea-boots. This style of slip-on boot is usually loose fitting and difficult to climb in. It is quite possible that the boots provided the seaman with inadequate traction on the ladder treads and that he lost his footing before falling from the ladder.

Since the seaman had removed his face mask, it is likely that he was carrying it when he fell. Carrying any item while climbing a ladder can make the task more difficult, as it can get snagged or interfere with the individual's hold on the ladder.

Any of these factors could have added to the difficulty that the seaman may have experienced while climbing the cargo hold ladder.

3 Seafarer's Training, Certification and Watchkeeping Code, International Maritime Organization, 1995.

Hydrochloric acid

The seaman was wearing a face mask while he was spraying the surfaces of the cargo hold with hydrochloric acid. However, it cannot be determined how well the mask had protected him. It is possible that he had been overexposed to the acid and that he was experiencing dizziness or headaches as he climbed the ladder.

There was also acid found on the seaman's face, around the area protected by his face mask. When the mask was removed, the acid would have mixed with the seaman's perspiration. This solution may have caused an irritation to his skin and/or eyes that may have distracted him.

Risk analysis

Cleaning *Oceanic Angel*'s cargo holds with acid was a task the chief mate and the crew were familiar with and they held a meeting at the start of the day to discuss the task.

The ship's safety management system (SMS) gave the crew guidance with regard to workplace safety. In reference to hazardous tasks, the SMS stated;

> Department Heads, when having their crew engaged in dangerous work, must ensure the safety of the work by taking the measures mentioned in Par 2.1 to Par 2.4[4] in accordance with the work. Also, beside checking those safety measures before the work is commenced, he must give in writing instructions and notes necessary for the work in question to the chief of the work.

However, the chief mate did not carry out a formal risk analysis for the task of preparing the cargo holds for the upcoming cargo and no written instructions were issued.

Had the hazards associated with preparing the holds for the upcoming cargo been formally analysed, the risks posed by the possible overexposure to hydrochloric acid may have been identified. Furthermore, the risks involved with climbing the cargo hold ladder at the end of the day may have also been identified.

Material Safety Data Sheet (MSDS)

The labels on the acid drums had alerted the chief mate and the crew to its corrosive nature and they had decided to use PPE that was appropriate for the task. However, they were not aware of all of the hazards associated with hydrochloric acid.

While the master was able to provide the ATSB investigators with a copy of the MSDS for hydrochloric acid, the chief mate and the crew were not aware that the document existed. Furthermore, they were not aware of the essential safety information provided by a MSDS. In fact, they did not know what a MSDS was.

Therefore, had they carried out a formal risk analysis it would have been ineffective because a risk assessment carried out without reference to the appropriate MSDS would have been incomplete.

Findings

From the evidence available, the following findings are made with respect to the crew member fatality that occurred on board *Oceanic Angel* on 8 August 2007. The findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The seaman may have been tired at the end of what had been an arduous day's work in tropical conditions.
- The personal protective equipment that the seaman was wearing, or carrying, may have increased the difficulty he experienced while climbing the cargo hold ladder.
- The seaman may have been distracted as a result of a mixture of perspiration and hydrochloric acid that would have caused irritation to his skin and/or eyes.
- The ship's crew did not adequately consider all of the risks associated with preparing the cargo holds with hydrochloric acid.
- The ship's safety management system was not effective in ensuring that the crew carried out a formal risk analysis for the hazardous task of preparing the cargo holds with hydrochloric acid. *[Safety Issue]*
- The ship's crew were not aware of the safety information provided by material safety data sheets. *[Safety Issue]*

4 Paragraphs 2.1 to 2.4 outline the safety measures required when carrying out tasks such as; working at height, over the ship's side, painting and de-scaling work.

Safety Actions

ATSB safety advisory notices

MS20080001

The ship's safety management system was not effective in ensuring that the crew carried out a formal risk analysis for the hazardous task of preparing the cargo holds with hydrochloric acid.

The ATSB advises that Dojima Marine should consider the safety implications of this safety issue and to take action where it is considered appropriate.

MS20080002

The ship's crew were not aware of the safety information provided by material safety data sheets.

The ATSB advises that Dojima Marine should consider the safety implications of this safety issue and to take action where it is considered appropriate.

Media release

Seaman dies after a fall from a ship's cargo hold ladder

The ATSB has found that a seaman may have been fatigued when he fell from a bulk carrier's cargo hold ladder at the end the working day on 8 August 2007.

The Australian Transport Safety Bureau investigation also found that he may have been distracted by the equipment he was carrying and as a result of a mixture of perspiration and hydrochloric acid that would have caused irritation to his skin and eyes.

On 8 August 2007, *Oceanic Angel* was about three degrees south of the equator and en-route to Dampier, Australia.

After lunch, the crew were preparing the cargo holds for an upcoming salt cargo and, at about 1515, two seamen started work in number three hold. They began by spraying the dirty areas of the hold with hydrochloric acid, starting at the aft end and moving forward along the port side.

At about 1630, they stopped work for the day. One of the seamen made his way to the cargo hold's aft ladder and started climbing out of the hold. The other seaman went to the forward ladder to do likewise. When the seaman on the aft ladder was almost at the ladder's top platform, about 11.7 m above the tank top, he heard a loud 'thump'. He turned around and saw his colleague lying on the tank top.

The crew mounted an emergency response but the seaman had died as a result of the fall.

At 2300 on 17 August, *Oceanic Angel* berthed in Dampier. The local police attended the ship and the deceased seaman was taken ashore.

The ATSB investigation found that the ship's safety management system was not effective in ensuring that the crew carried out a risk analysis for the task of cleaning the cargo holds with hydrochloric acid. It also found that the crew were not aware of the safety information provided by material safety data sheets.

The ATSB has issued two safety advisory notices with the aim of preventing similar occurrences from occurring in the future.

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