Office of the Chief Investigator
Transport Safety

Marine Safety Investigation
Report No 2009/12

Breakaway from Berth

MT Leyte Spirit

Gellibrand Pier Melbourne

21 August 2009

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THE CHIEF INVESTIGATOR

The Chief Investigator, Transport Safety is a statutory position under Part 7 of the *Transport Integration Act 2010*. The objective of the position is to seek to improve transport safety by providing for an independent no-blame investigation of transport safety matters consistent with the vision statement and the transport system objective.

The primary focus of an investigation is to determine what factors caused the incident, rather than apportion blame for the incident, and to identify issues that may require review, monitoring or further consideration. In conducting investigations, the Chief Investigator will apply the principles of 'just culture' and use a methodology based on systemic investigation models.

The Chief Investigator is required to report the results of investigations to the Minister for Public Transport and/or the Minister for Roads and Ports. However, before submitting the results of an investigation to the Minister, the Chief Investigator must consult in accordance with section 85A of the *Transport (Compliance and Miscellaneous) Act 1983*.

The Chief Investigator is not subject to the direction or control of the Minister(s) in performing or exercising his or her functions or powers, but the Minister may direct the Chief Investigator to investigate a transport safety matter.

EXECUTIVE SUMMARY

On the morning of 21 August 2009 the Bahamian registered crude oil tanker MT Leyte Spirit was discharging crude oil at the Mobil Gellibrand Terminal in the Port of Melbourne.

At about 0950[1] a severe squall with winds of up to 68 knots passed over the terminal causing the vessel to breakaway from its berth. As a consequence, the terminal cargo arm broke. The vessel reported that about 100 litres of crude oil that dripped onto its deck was contained within the vessel but about 40 litres of crude oil from the severed cargo arm spilled directly into the water.

The investigation found that the squall line developed very rapidly and was detected by the Bureau of Meteorology shortly after 0900. A warning was issued by them at 0912 and was broadcast by Coast Radio Melbourne at 0915 however neither the terminal nor the vessel received the warnings. When the squall struck, the vessel was able to stop discharging cargo about one minute before it broke away from the berth.

The investigation found that Mobil Gellibrand and Leyte Spirit did not have appropriate systems in place to obtain and share local weather information and recommends that Leyte Spirit develop procedures for obtaining local weather information.

Since the incident the vessel's owners have circulated a Fleet Notice advising all vessels to be vigilant and to take appropriate action against unpredictable weather. Mobil Gellibrand Terminal have subscribed to the Bureau of Meteorology service to obtain directly by facsimile all relevant weather bulletins and have updated their procedures to ensure that vessels are aware of local weather warnings. The Harbour Master's Directions have been updated to advise vessels how to obtain local weather information.

[1] All times are in AEST (Australian Eastern Standard Time).

1. CIRCUMSTANCES

On the morning of 21 August 2009 the crude oil tanker MT Leyte Spirit was discharging crude oil at the Mobil Terminal at Gellibrand Pier, Melbourne.

It was made fast to the pier with 16 mooring lines (Figure 4), on a heading of about 033^0 True.

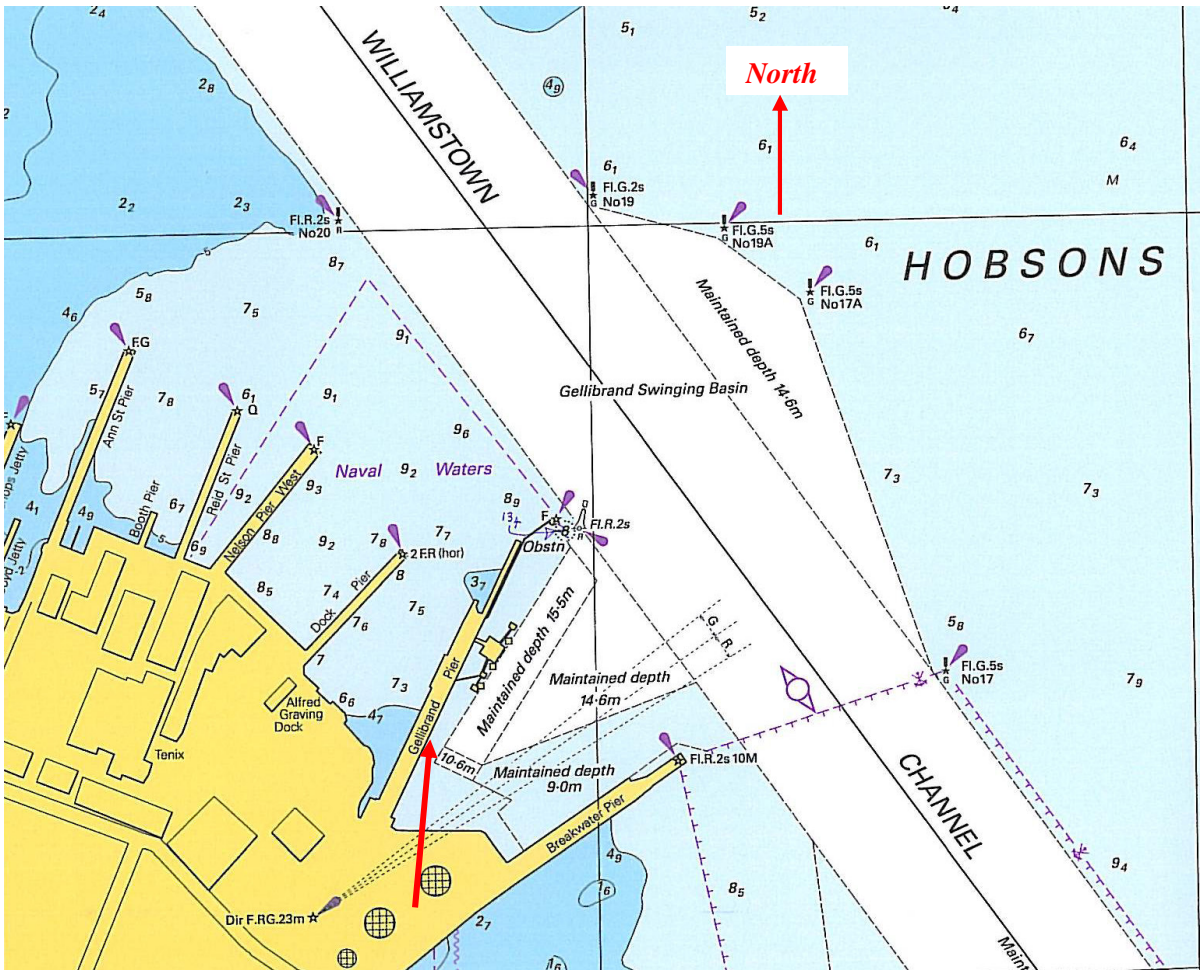


Figure 1 – Gellibrand Pier

At the time of the incident the maintained depth was 12.1 metres.

To effect discharge, the terminal cargo arm (articulated steel hose pipe) was connected to the vessel's cargo manifold and the discharge rate was set at 2,200 cubic metres per hour.

Figure 2 – Shore cargo arm connected to vessel's manifold (The vessel pictured is not Leyte Spirit)

During the discharge operation there were two ratings stationed on deck and the chief officer and the third officer were in the cargo control room inside the accommodation. There was also the shore Expeditor in the cargo control room, employed by the terminal to monitor the amount of cargo discharged.

On the shore side, the terminal was manned by a MAT (marine asset technician) stationed in a cabin located near the entrance gate and a TSSO (tanker safety and security officer) stationed in a cabin located on the pier near the crosswalk to the loading platform.

During the morning the wind was northerly at about 20 knots with occasional gusts[2] between 27 and 30 knots. At about 0915 CRM (Coast Radio Melbourne) broadcast a top priority squall warning (Appendix C) advising that wind squalls around 50 to 60 knots were expected to move through Port Philip within the next hour. The warning was broadcast on VHF channel 67, preceded by an announcement on VHF channels 12 and 16. The vessel and the terminal did not hear the announcement.

At about 0950 the wind started increasing as a line squall approached. At 0953 the vessel activated the cargo pump emergency stop switch to cease pumping. The increasing wind caused the vessel's mooring lines to render[3] and at about 0954 the vessel's stern started moving away from the wharf.

When the vessel had moved about 10 metres off the wharf the cargo arm, which was bolted to the vessel's manifold, fractured at the connecting flange (Figure 3). The wind at that moment was observed by the vessel to be north-westerly at 68 knots. The vessel reported that the oil dripping from its severed manifold was caught in the vessel's drip

[2] A gust is a sudden sharp increase in the wind force usually lasting for at least three and not more than twenty seconds.

[3] The drum holding the mooring line is designed to release the mooring line ("render") when the strain on the line exceeds the holding power of the drum brake thereby preventing the lines from parting.

tray. About 100 litres of crude oil that dripped from the cargo arm onto the deck was contained by the vessel however, about 40 litres of crude oil from the cargo arm spilled directly into the water.

Melbourne VTS (Vessel Traffic Service) was notified of the oil spill by a passing vessel which they confirmed with Leyte Spirit and the VTS then activated the Victorian oil spill response plan. The Mobil Refinery in Altona was also notified of the oil spill by the shore attendants and the refinery activated their oil spill response plan for the terminal.

Leyte Spirit stopped moving away from the berth when her bow was about 10 metres off the wharf and her stern was about 80 metres off the wharf. With the assistance of two tugs pushing, the vessel used its mooring winches to tighten its lines and at about 1135 was brought alongside and made fast to the pier. The clean up operation of the water in the vicinity of the pier was completed at about 1700.

Figure 3 – Fractured shore cargo arm as seen from the vessel

2. FACTUAL INFORMATION

2.1 Background

2.1.1 Cargo operations

MT Leyte Spirit arrived at Gellibrand Pier at about 0900 on 19 August 2009. The vessel was made fast to the pier by eight mooring lines forward and eight mooring lines aft; in accordance with the terminal's requirements and the vessel's mooring plan for a routine berthing operation.

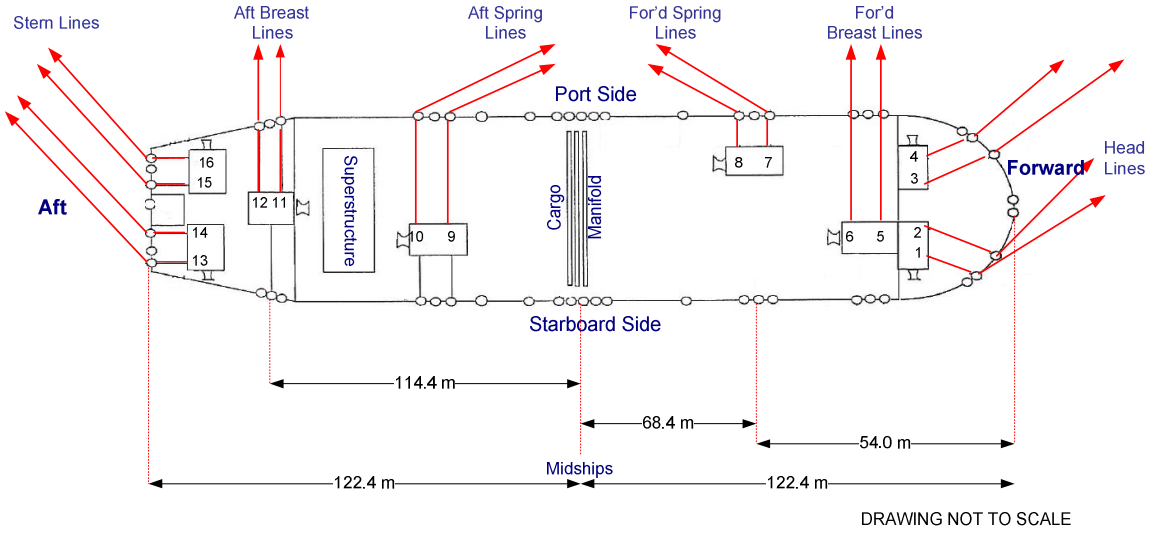


Figure 4 – Mooring diagram for vessels at Gellibrand Pier

Once secured, the ship-shore safety meeting took place between the vessel and the terminal. The discharge schedule and the safety requirements of the terminal and the vessel were discussed in accordance with OCIMF[4] (Oil Companies International Marine Forum) guidelines and the ISGOTT[5] (International Safety Guide for Oil Tankers and Terminals) safety checklist (see Section 2.10.3).

The parties agreed that cargo discharge should cease if the wind reached 35 knots and to disconnect the cargo arm if the wind reached 45 knots. Unberthing would be with agreement of the regulatory authority and the master.

The terminal's 300 mm diameter cargo arm was connected to the vessel's manifold with 12 bolts (Figure 5). The bolts were tightened by a pneumatic impact wrench but final tightening was by manual hammering. In accordance with the terminal's policy, cargo arm connection was carried out by an independent contractor for the terminal.

[4] The OCIMF: Oil Companies International Marine Forum (OCIMF) is internationally recognised as an authority on the safe and environmentally responsible operation of oil tankers and terminals.

[5] ISGOTT is the IMO recognised definitive Guide to the safe carriage and handling of crude oil and petroleum products on tankers and at terminals, jointly published by the OCIMF. The ICS (International Chamber of Shipping and the IAPH (International Association of Ports and Harbours).

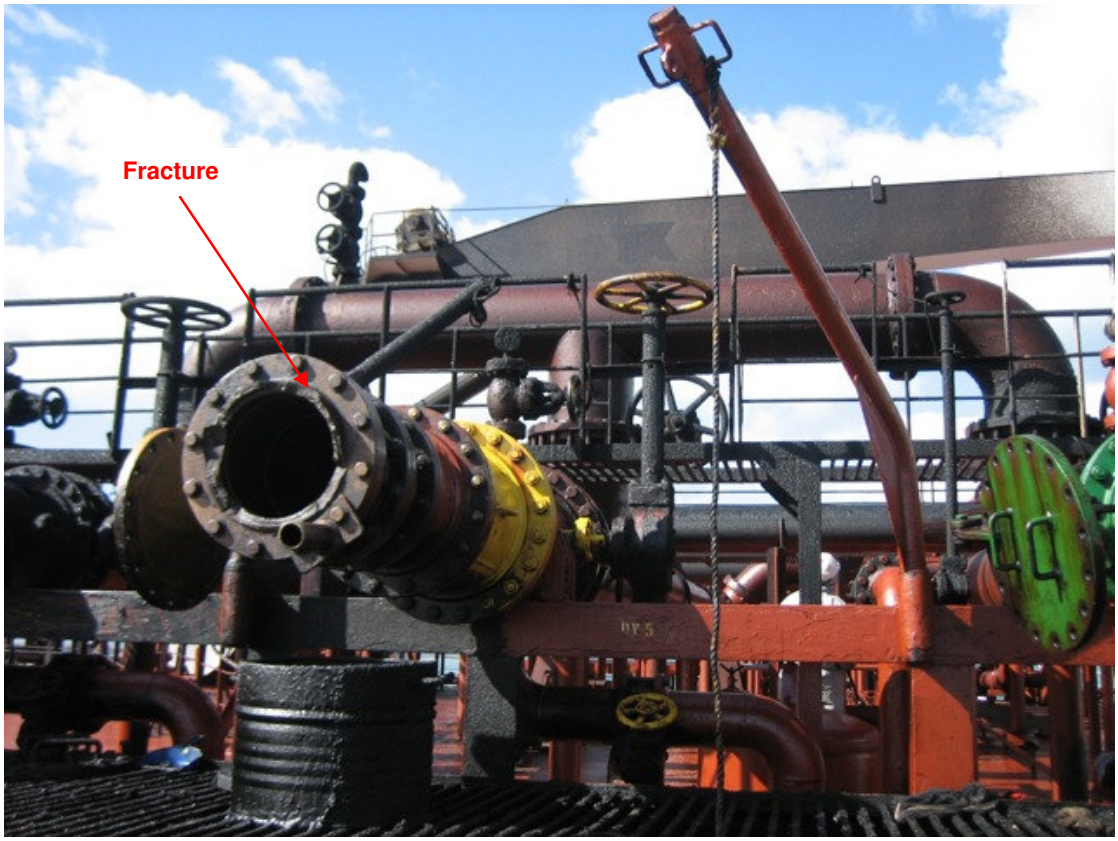


Figure 5 – Vessel cargo manifold. The flange of the fractured shore cargo arm is still connected to the manifold.

The vessel and the terminal remained in contact with each other by UHF radio (walkie-talkie) and mobile phone, supplied by the terminal.

Cargo discharge commenced at 1312 on 19 August and was stopped at 0506 on 20 August at the terminal's request. Cargo discharge resumed at 0012 on 21 August 2009 at a rate of about 2,200 cubic metres per hour.

2.2 MT Leyte Spirit

2.2.1 Ship particulars

MT Leyte Spirit (Appendix A) is a crude oil tanker of 57,448 gross registered tonnes, owned and operated by Teekay Navion Offshore Loading Pte Ltd, Singapore. It arrived in Melbourne with 527,685 barrels[6] of crude oil for Mobil Oil Australia Ltd and this was its fifth visit to Gellibrand Pier. At the time of the incident the vessel was registered in the Bahamas and classed with Lloyd's Register of Shipping.

Leyte Spirit has an overall length of 244.8 metres, a moulded breadth of 41.2 metres, a moulded depth of 21.6 metres and summer draft of 14.418 metres. At the time of the incident the vessel had about 208,000 barrels of crude oil remaining on board. Its draught was 5.0 metres forward and 9.5 metres aft. The vessel's superstructure rises about 17.6 metres above the deck and the total wind surface area on its beam was calculated to be about 3900 m^2.

[6] 1 barrel = about 136 kg.

The vessel's navigational and radio communication equipment complied with the requirements of Chapters IV and V of SOLAS (International Convention for the Safety Of Life at Sea 1974, as amended).

2.2.2 Radio communications equipment

The vessel's radio communication equipment consisted of:

- An Inmarsat[7] ship earth station System B, capable of transmitting and receiving distress, safety and routine communications using direct-printing telegraphy (telex), radiotelephony and facsimile.
- An Inmarsat ship earth station System C, capable of transmitting and receiving distress, safety and routine communication using direct-printing telegraphy.
- A VHF (Very High Frequency) marine radio, capable of transmitting and receiving distress, safety and routine communications using radio telephony.
- An MF/HF (medium frequency/high frequency) marine radio, capable of transmitting and receiving distress, safety and routine communications using radio telephony and direct-printing telegraphy.
- An Orion[8] Program for the receipt of weather charts.

At the time of the incident the vessel's systems were reported to be operational and were set up to automatically receive weather bulletins by telex (Inmarsat C) and facsimile (Inmarsat B) and weather charts on Orion. The vessel received a telexed weather report via its Inmarsat C system issued by the Bureau of Meteorology at 0505 (Appendix D) and again at 0522 (Appendix E) on the day of the incident, forecasting winds 30 to 40 knots later in the day.

The (ALRS) Admiralty List of Radio Signals Vol 3 Part 2 – 'Radio Weather Services and Navigational Warnings' – which all vessels must carry, advises mariners that local weather bulletins and warnings for Port Phillip are broadcast on VHF channel 67 preceded by an announcement on VHF channel 16.

The vessel was maintaining a watch on VHF channel 12, in accordance with the Harbour Master's Directions, which is the designated working channel for the Port of Melbourne. The VHF radio was of a non-portable type, installed in the cargo control room. They were not monitoring the HF radio channels or VHF channels 16 and 67.

2.2.3 Mooring equipment

Leyte Spirit's mooring system was designed and constructed in accordance with the OCIMF's "Effective Mooring Guidelines" (see Section 2.10.1). The vessel is fitted with four hydraulically operated mooring winches in the bow and four in the stern. Each winch controls two 'self-stowing' mooring drums. Each drum holds a galvanised steel mooring wire of length about 305 metres and 80 tonnes minimum breaking limit. The diameter of each wire ranged between 34 and 38 mm.

The end of each mooring wire (Figure 6) is connected to a synthetic fibre rope (mooring tail) of length 11 metres, diameter 80 mm and 120 tonnes minimum breaking limit. The shackle connecting the wire to the fibre rope had a breaking strength of 120 tonnes.

[7] 'International Mobile Satellite Organisation' (Inmarsat) for ship to shore radio communications, established by the Convention on the International Maritime Satellite Organisation.

[8] Orion is an internet based website that provides weather charts sourced from various National meteorological agencies.

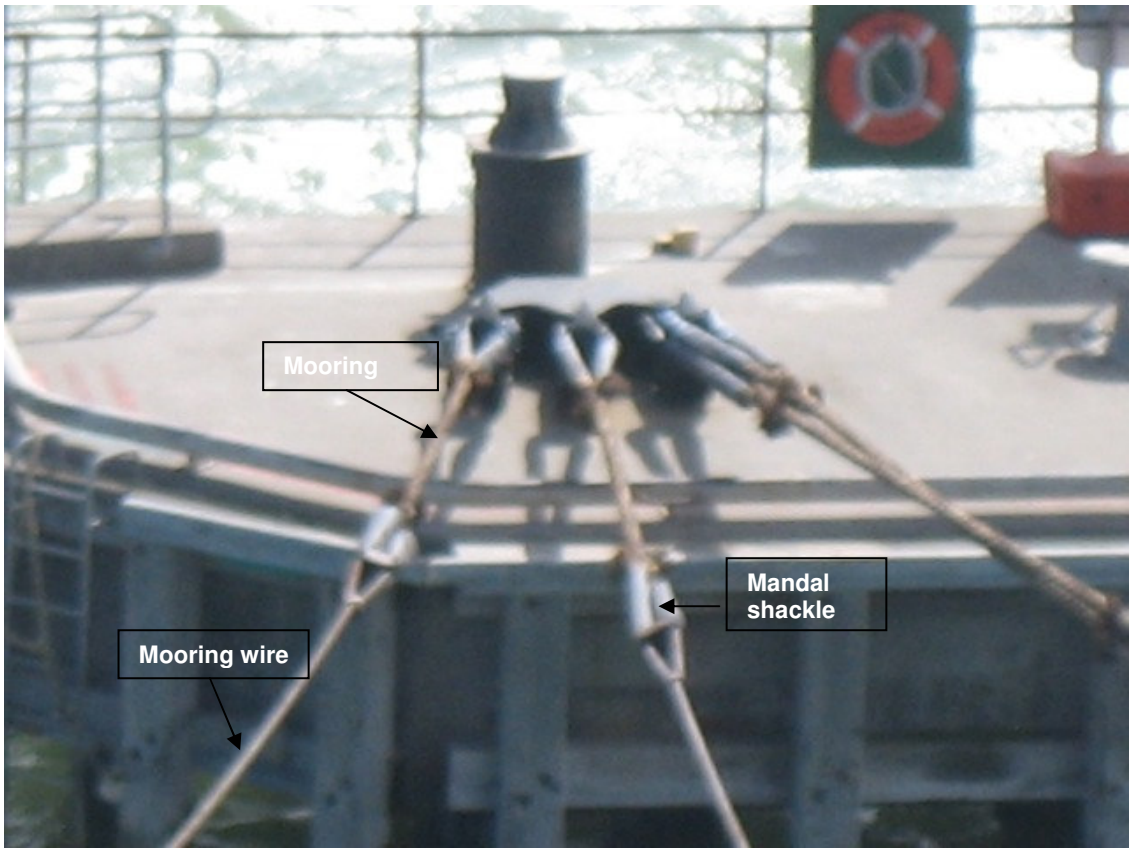


Figure 6 – Mooring lines

Each drum is held by a band brake, the brake is tightened by manually turning a screw spindle (Figure 7). The brake linings of all drums were renewed in October 2007 except for No 3 winch, which was replaced in July 2009. The design brake holding power of each winch drum was 48 tonnes. They were last tested in accordance with the vessel's continuous survey cycle in July 2009 and were recorded to have rendered at between 50 and 53 tonnes.

To tighten or slacken a line, the respective mooring drum is manually coupled to the winch motor then the brake released by unscrewing the spindle. Once the line has been tightened or released as required, the spindle is screwed to tighten the brake and the drum is uncoupled from the motor. The vessel crew reported that just prior to the incident they checked all moorings and found them to be tight.

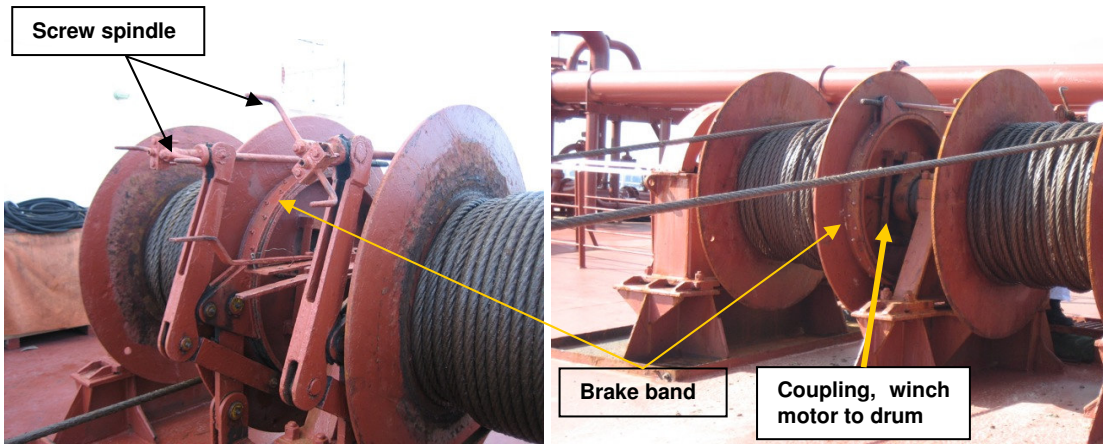


Figure 7 – Typical mooring winch on MV Leyte Spirit (front view and reverse view)

After the incident the mooring winches were independently inspected by surveyors from Lloyds Classification Society, AMSA (Australian Maritime Safety Authority) and the terminal, all of whom found that the winches and their brake drums were in a satisfactory condition and that the brake lining had not suffered wear or 'burn out' (Figure 8).

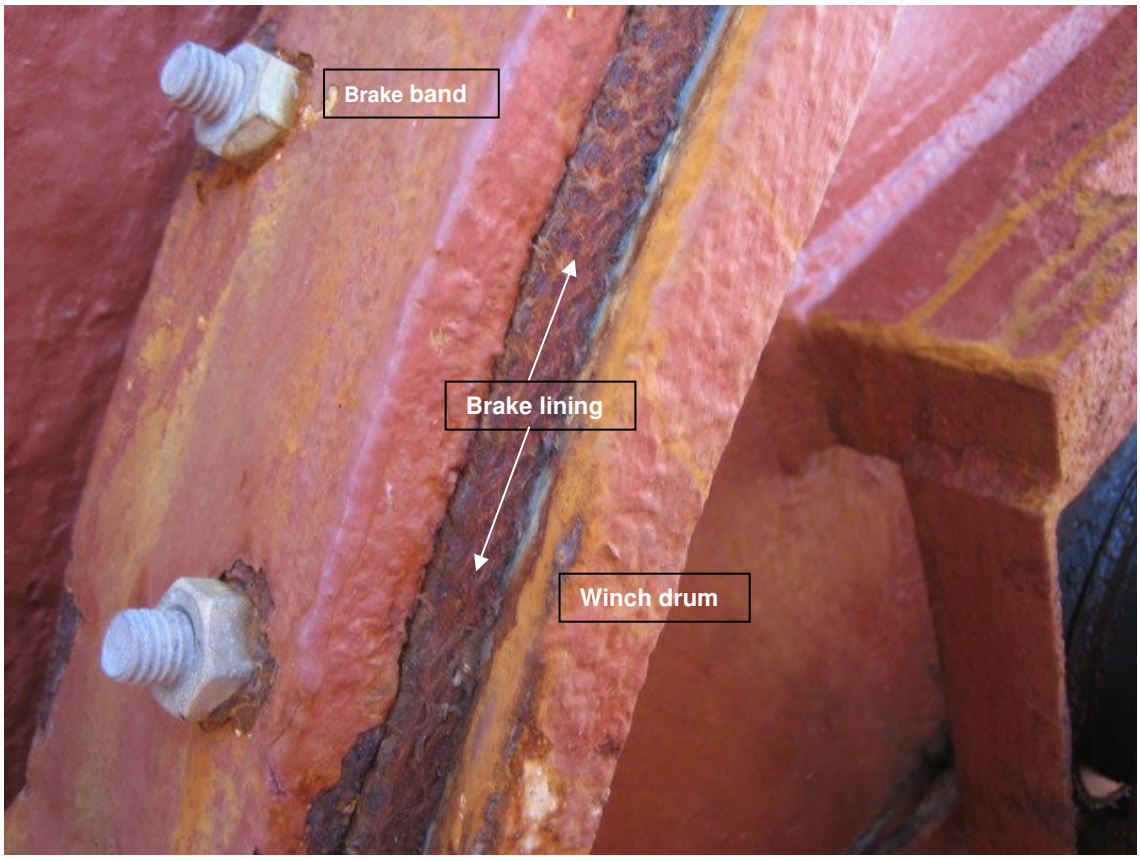


Figure 8 – Close-up of winch brake assembly post incident

2.2.4 Watchkeeping arrangements

In accordance with Leyte Spirit's 'Standard Operating Practice', the chief officer is the nominated person-in-charge of cargo operations. The chief officer sets the discharge schedule in conjunction with the terminal supervisor. He oversees the safety of the vessel and ensures all vessel systems are correctly operating during the discharge operation. He does not maintain a cargo watch.

The cargo watch comprises the duty officer stationed in the cargo control room and two deck ratings stationed on deck. The pumpman is available to assist whenever required. The duty officer's work to a six hours on – six hours off watchkeeping rotation whilst the ratings work to a four hours on – eight hours off rotation.

The duty officer supervises the vessel's discharge (or loading) operation and issues orders to the ratings as required. The officer is required to monitor the cargo pumps, tank gauges, line and tank pressures and tank washing. Before taking over the watch or after handing over the watch, the officer must make a round on deck to satisfy himself that the moorings, gangway and manifold connections are secure and that the pumps are operating satisfactorily.

The vessel's Standard Operating Practice required the officer of the watch to maintain a close watch on the weather, especially with regards to wind speed and possibility of lightning but did not provide guidelines on how to maintain a "close watch" on the weather. In practice, the duty officer relied on visual observations of the weather and at the end of the watch, would check and sign any weather reports that may have arrived. On the morning of the incident, the second officer checked and initialled the 0522 weather report at the end of his watch at 0600. There is no evidence that he discussed the report with any other person.

The two ratings stationed on deck during cargo operations monitor the manifold connections, gangway and moorings. They are also required to undertake general deck and security duties. One of the ratings is required to make a round of the vessel at least once every hour to check on those items coded 'R' in the ship-shore safety checklist. This includes an inspection of the moorings and the pumproom. Communication between watchkeepers is maintained by 2-way UHF radio (walkie-talkie).

At the time of the incident the third officer was stationed in the cargo control room and an able bodied seaman and an ordinary seaman were stationed on deck. The chief officer was also present in the control room. The master's, chief officer's and all watchkeepers' schedules of work and rest for the previous three days indicate that each was permitted at least 10 hours rest per day. Their medical records indicated that they were fit for duty and not under any medication.

Post incident, the master, chief officer and watchkeepers were tested for alcohol and drugs and no traces were found.

2.3 Personnel

2.3.1 Master, Leyte Spirit

The master of Leyte Spirit had about 42 years seagoing experience, having started his career as a deck cadet in 1967. He obtained his certificate of competency as Master in 1979 and from about that time has been in command of vessels. This was the master's seventh voyage (each voyage averaged about four months) as master of Leyte Spirit but his first time as master of Leyte Spirit visiting Gellibrand Pier.

At the time of the incident the master held a certificate of competency as Master issued by the Commonwealth of the Bahamas in accordance with the STCW[9] on 20 July 2005 and valid until 14 April 2010. The certificate was considered appropriate by the Flag State[10] to act as master of Leyte Spirit.

2.3.2 Chief Officer, Leyte Spirit

The chief officer of Leyte Spirit had about 15 years seagoing experience, having started his career as a deck cadet in 1993. He obtained his certificate of competency as Chief Officer in 2007 and from about that time has been serving as chief officer. This was the chief officer's first visit to Gellibrand Pier on Leyte Spirit.

At the time of the incident the chief officer held a certificate of competency as Chief Mate issued by the Commonwealth of the Bahamas in accordance with the STCW on 9 July 2008 and valid until 28 May 2013. The certificate was considered appropriate by the Flag State to act as chief officer of Leyte Spirit.

2.3.3 Third Officer, Leyte Spirit

The third officer of Leyte Spirit had about 24 years seagoing experience, having started his career in 1984. He obtained his certificate of competency as watchkeeping officer in 1995 and from about that time has been serving as a third officer. This was the third officer's first visit to Gellibrand Pier on Leyte Spirit.

At the time of the incident the third officer held a certificate of competency as Officer in Charge of a Navigation Watch issued by the Commonwealth of the Bahamas in accordance with the STCW on 27 January 2006 and valid until 5 December 2010. The certificate was considered appropriate by the Flag State to act as third officer of Leyte Spirit.

2.3.4 Able Bodied Seaman, Leyte Spirit

The able bodied seaman (A.B.) on duty at the time of the incident had about 10 years seagoing experience. He had been serving on Leyte Spirit since February 2009 and this was his first visit to Gellibrand Pier on this vessel.

2.3.5 Ordinary Seaman, Leyte Spirit

The ordinary seaman (O.S.) on duty at the time of the incident had about three years seagoing experience. He had been serving on Leyte Spirit since March 2009 and this was his first visit to Gellibrand Pier on this vessel.

2.4 Written statements

2.4.1 Master, MT Leyte Spirit

The master stated that first thing on the morning of 21 August 2009, he checked the weather reports received that day and noted that the Australian Bureau of Meteorology report issued at 0505 warned of gale force northerly winds (see section 2.8 Environment). He stated that he intended to discuss the day's discharging operation in light of the expected weather with the chief officer and the Expeditor at about 1000.

[9] The International Maritime Organisation's International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended.
[10] Commonwealth of the Bahamas.

During the morning the wind speed held steady at about 22 to 26 knots but at about 0952 the master looked out of his porthole and noticed that the wind had become significantly stronger. He switched on his walkie-talkie and heard the able seaman report to the chief officer that "the wind has become very, very strong". The master immediately called the cargo control room and ordered the chief officer to "consider this an emergency, trip the pump, stop the cargo pump immediately".

About a minute later the vessel's stern moved away from the berth and with it, the terminal cargo arm extended and broke away from the vessel's manifold. As the cargo arm broke away, the residual oil in the pipe poured onto the deck.

The master went to the bridge and noted that the wind speed on the bridge anemometer was about 60 knots. He sounded the emergency alarm and ordered all hands on deck to deal with the oil spill emergency. Whilst the crew started emergency containment and clean-up operations, the master reported the incident to VTS (Vessel Traffic Services) Melbourne and ordered two tug boats to come to the assistance of the vessel.

2.4.2 Chief Officer, MT Leyte Spirit

The chief officer was in the cargo control room along with the third officer. He stated that they did not receive any advance warning of storm force winds and that during the morning the wind speed was steady between 15 and 20 knots. He stated that they were monitoring VHF channel 12 in the cargo control room.

At about 0945 the deck rating reported to him by walkie-talkie that "all was secure on deck" but at about 0950 he noticed a sudden increase in wind strength. Soon thereafter, the deck rating reported to him that the wind had become very strong immediately followed by the master ordering him to trip the cargo pumps. The chief officer stated that he checked the control room's anemometer and noticed that the wind speed was about 68 knots.

The chief officer immediately tripped the pumps, stopped the inert gas system and opened the master riser remote valve in order to reduce the pressure in the piping system. He stated that he noticed the vessel's stern move away from the wharf but he did not see the terminal cargo arm break away from the manifold.

2.4.3 Third officer, MT Leyte Spirit

The third officer stated that at about 0930 that morning he did a safety round on deck and confirmed that all mooring lines were satisfactorily tight and returned to the cargo control room at 0940. When he returned he observed the wind speed on the anemometer to be about 20 to 22 knots.

The third officer confirmed that the deck rating reported "strong wind" immediately followed by the master's order or trip the cargo pumps and stated that the chief officer tripped the pumps immediately. He stated that he could see that the stern had moved away from the wharf. He went on deck, opened the slop tank dump valve and started the portable pump to drain the oil on deck into the slop tank.

On the orders of the master, the third officer together with two deck crew commenced heaving on the winches to tighten the aft breast lines and spring lines. He stated that when bringing the vessel alongside again, the winches operated normally and he could not detect any damage to the brakes.

2.4.4 Able bodied seaman, MT Leyte Spirit

The A.B. stated that at about 0930 that morning he started his hourly safety round of the vessel. He checked the vessel's winches and mooring lines and found that all the lines were tight and did not require adjusting.

On completing the safety round, the A.B. relieved the O.S. at the gangway, and the O.S. proceeded to inspect the pump room. The A.B. stated that just after that the wind suddenly became very strong and he reported it to the cargo control room. Immediately after that, he heard the master order the emergency tripping of the cargo pumps.

The A.B. noticed the cargo arm extend and break away from the vessel manifold and oil was being blown over the deck. Some time later the seaman assisted the third officer to tighten the lines. He stated that he did not notice any damage to the winches.

2.4.5 Chief Engineer, MT Leyte Spirit

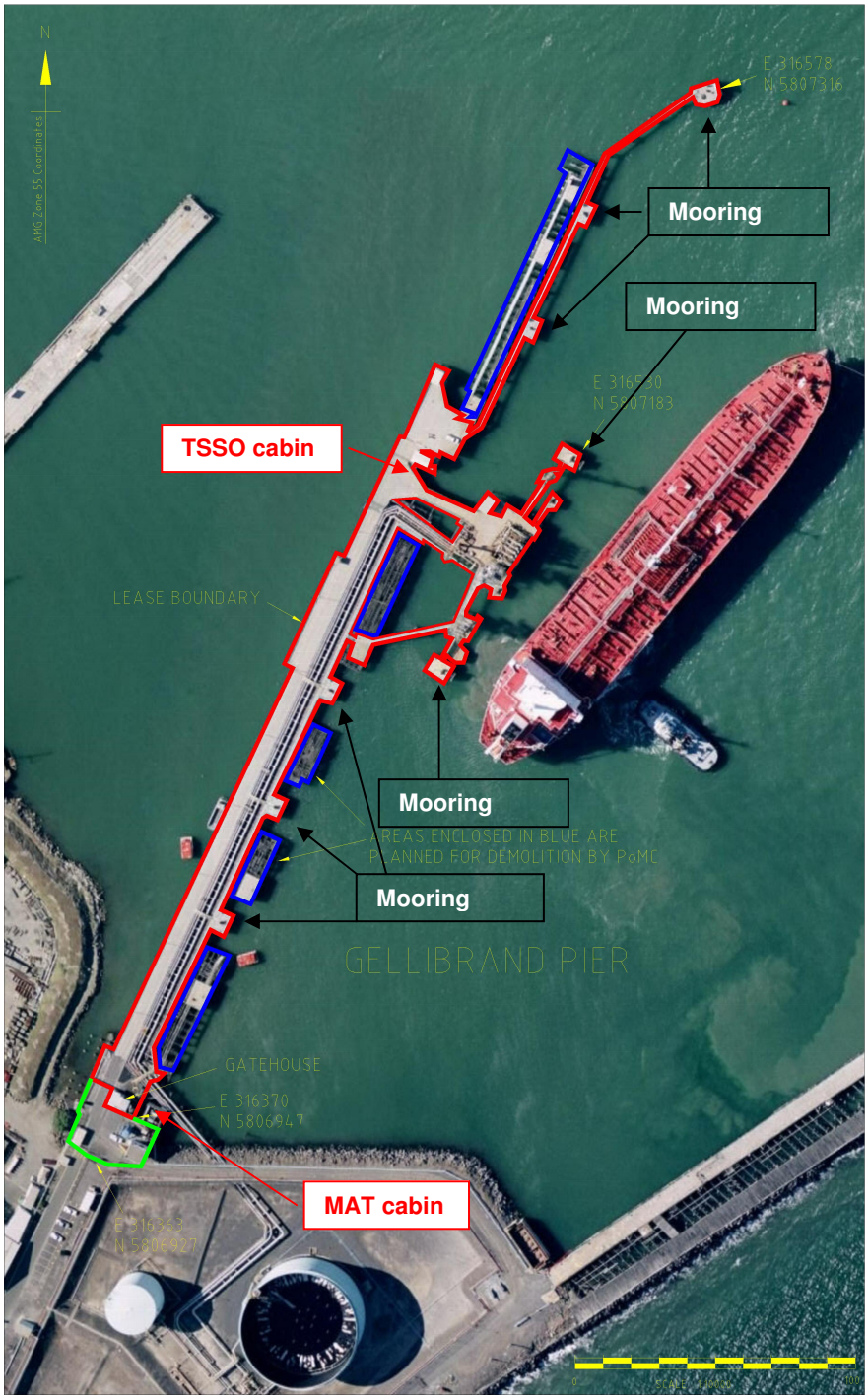
The chief engineer was in his cabin when he looked out and noticed that the A.B. on deck was struggling to stand upright in strong winds. He immediately went down to the cargo control room and noted that the chief officer had already tripped the cargo pumps.

Soon thereafter the master ordered him to provide a condition report on the winches. He stated that he inspected the four aft winches first and worked his way to the forward winches. He could not see any damage to the winches or the mooring cables. The chief engineer stated that all brake linings also appeared to be in order and opined that "the winch brakes simply rendered under excessive load".

2.5 Gellibrand Pier

2.5.1 Infrastructure

Gellibrand Pier is a crude oil berth in the Port of Melbourne. It is located in Hobson's Bay at Williamstown (Appendix B). The berth is a typical tanker berth consisting of a finger pier with a crosswalk, connecting to the loading platform which holds the gangway tower and the terminal cargo arm manifold. The pier and the berthing infrastructure is owned by the Port of Melbourne Corporation and leased to Mobil Refining Australia Pty Ltd. Mobil owns, maintains and operates the cargo working equipment and is responsible for all cargo operations at the terminal.



Note:

The area enclosed in red is the lease boundary and the areas marked in blue are earmarked by Port of Melbourne for demolition.

Figure 9 – Aerial view of Gellibrand Pier (The vessel pictured is not Leyte Spirit)

The pier is 3.7 metres above the water line. The berth can accommodate vessels up to 250 metres in length with a maximum draught of 11.2 metres. The maintained depth at the berth at the time of the incident was 12.1 metres.

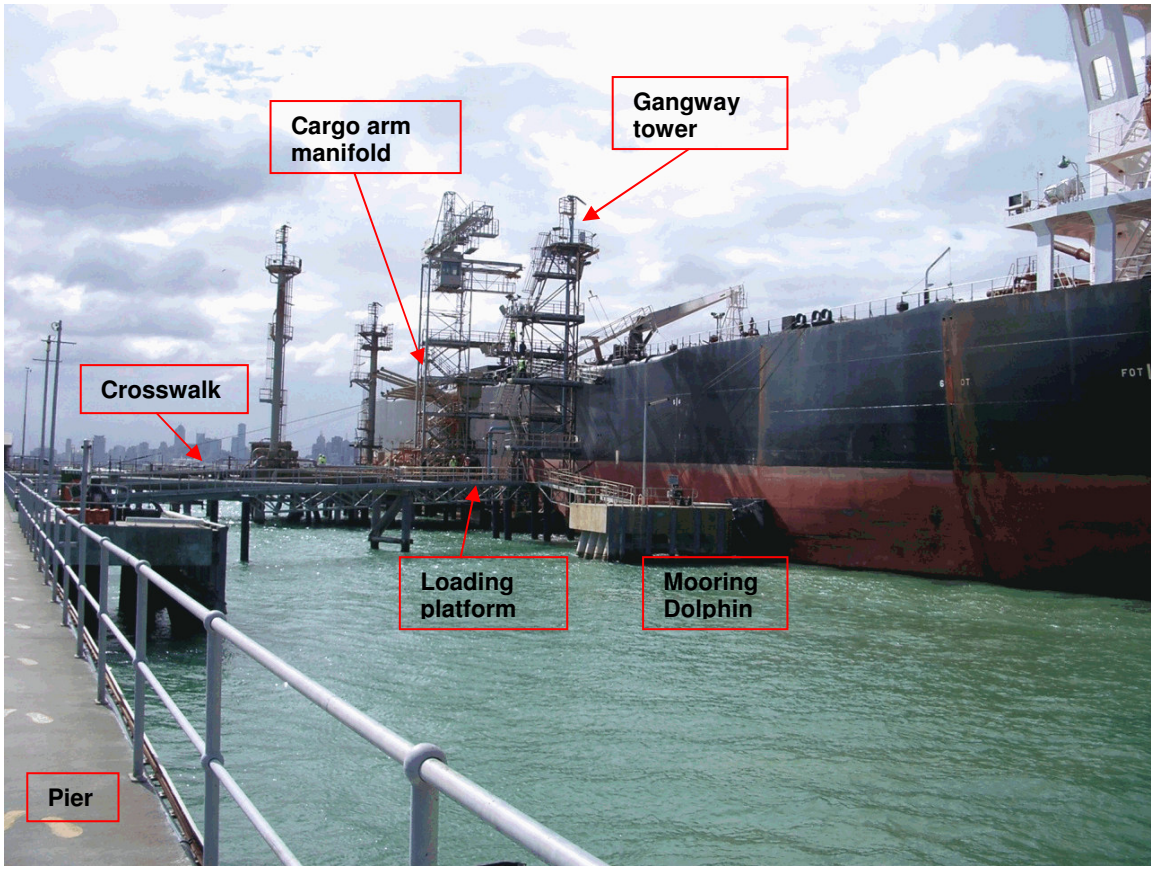


Figure 10 – Gellibrand Pier

The loading platform houses the cargo arm manifold and tower and the gangway tower. The manifold has four articulated cargo arms. The pipelines run from the terminal manifold along the crosswalk to the pier and thence along the pier to the storage tanks located outside the terminal. On either side of the loading platform is a rigid concrete mooring dolphin. When berthed, the vessel rests alongside the loading platform and the dolphins, on a heading of about 033^0 True.

There is also a series of mooring points constructed along the length of the pier (Figure 9). Each mooring point and mooring dolphin has a capstan with a triple mooring swivel slip hook (Figure 11) to secure the vessels' mooring lines.

In accordance with the OCIMF Mooring Equipment Guidelines, the terminal advised that they had conducted a dynamic analysis of site specific environmental data and mooring line loads, which determined the mooring configuration of vessels at the berth and the wind forces at which cargo should be stopped and cargo arm disconnected. They advised that the dynamic analysis also reviewed sudden wind gusts and meteorological squalls. However, the investigation has not been able to obtain a copy of the test results of the dynamic analysis.

Figure 11 – Capstan with triple swivel hook assembly

2.5.2 Terminal operations

On average, there is a tanker discharging or loading crude oil at Gellibrand Pier for about five to seven days every fortnight.

In accordance with Mobil Gellibrand safe working policy, cargo arm connection and disconnection was effected by a private contractor, even in the case of any emergency. The 'hose crew' was not stationed at the terminal and their availability to attend was between two and four hours. The terminal advised that disconnection of the cargo arm could not be effected until the line was drained of oil and washed with hot water, which usually took about 30 minutes.

In their risk assessment, the terminal was satisfied that the probability of the cargo arm parting was not significant, therefore there was no need to have a hose crew stationed at the berth. They were satisfied that provided they could have the cargo arm drained and washed, they would be safe from the risk of oil pollution in the event of the cargo arm parting.

2.5.3 Personnel

In accordance with the Mobil 'Tanker Facility Operations Manual', during cargo operations, the terminal is manned by a MAT stationed in a cabin located on shore near the entrance gate and a TSSO stationed in a cabin located on the pier near the crosswalk to the loading platform. There is also a security guard stationed at the entrance gate.

In accordance with the operations manual, the MAT is responsible for coordinating and managing the cargo transfer operation from the vessel to the refinery and provides instruction as necessary to the TSSO and the security guard. The MAT is also required

to conduct regular routine inspections of the vessel's moorings, discharge lines, and similar junctions between the vessel and the terminal. It is the adopted practice that the MAT maintains regular communication with the vessel.

The TSSO monitors the safety and security of the vessel and the terminal in relation to the position and condition of the manifold connections, gangway and moorings and is also required to make regular inspection rounds of the berth and the vessel. The TSSO does not directly communicate or interact with the vessel, instead, he or she reports to the MAT who then communicates with the vessel.

The MATs and the TSSOs work 12 hour shifts. The shift change-over time is 0630 and 1830. Prior to the morning shift of 21 August, the MAT worked the 1830 to 0630 shifts on 18 and 19 August and had a rostered day off on 20 August; the TSSO worked the 0630 to 1830 shifts on 18, 19 and 20 August.

At the time of the incident the MAT was conducting an inspection of the crude tank farm located behind the MAT cabin and the TSSO was in his cabin monitoring the weather and the vessel.

There was also a terminal Expeditor stationed on Leyte Spirit for the duration of its stay. The Expeditor had a maritime background and was placed on board solely to protect the receiver's interests regarding the amount of cargo discharged from the vessel.

2.5.4 Appointment of MAT and TSSO

Mobil has a MAT accrediting officer on site who verifies the competency of an employee before endorsing their appointment. To be accredited, an employee must have a minimum of five years refinery operating experience. In addition, the employee must complete a series of short courses and prove their competence and their ability to manage refinery operations, tanker loading and discharging operations, emergency procedures and people management skills. Mobil does not require the MAT to have a maritime background.

The MAT at the time of the incident had about 20 years service overall with Mobil, and had obtained his MAT accreditation in 2008.

TSSOs at Gellibrand Pier are contract workers hired through a private security company. The terminal has not been able to provide the investigation with the criteria, if any, for appointing a TSSO.

2.5.5 Weather watchkeeping

A Davis Vantage Pro 2 weather station[11] was installed in each cabin providing the TSSO and the MAT respectively, with a digital reading of the prevailing weather. The weather station was set to provide an audible alarm if it detected winds of 35 knots or higher.

Mobil Gellibrand Terminal did not subscribe to BoM's weather broadcasting service. The MAT monitored the BoM website, when he believed he needed to, and also monitored commercial radio weather bulletins. Mobil did not have written guidelines for accessing BoM forecasts and warnings. At the time of the incident the MAT was not aware of the top priority squall warning. The investigation was advised that sometime during the morning, the TSSO heard on commercial radio of squalls occurring in other parts of Melbourne and he relayed this information to the MAT.

In their evidence, the terminal stated that they understood that PoMC, through CRM, was providing weather information to all vessels and therefore that satisfied the obligation under ISGOTT, to keep the vessel informed.

[11] The weather station provided real time information regarding the wind direction and force, atmospheric temperature, and pressure, relative humidity and dew point.

2.5.6 Interview, Marine Asset Technician

In his evidence, the MAT stated that on the morning of the incident he was stationed in the MAT cabin. From this position he could see the stern of the vessel and the loading platform. When he commenced his shift earlier that morning, the MAT stated that he accessed the BoM website and noted that winds up to 40 knots were predicted for the day. He stated that the wind was northerly during the morning and did not rise above 35 knots.

At about 0950 the MAT was conducting a routine tank inspection of the crude oil tank farm located behind the MAT cabin when he noticed the wind beginning to pick up. At the same time, the TSSO called him on the radio to report that he noticed strong wind gusts at the pier. The MAT returned to the cabin and heard the wind alarm beeping and as he looked out of the cabin window he observed Leyte Spirit's stern beginning to move away from the wharf.

He called to the vessel to stop cargo and was told that cargo was stopped. Soon thereafter, the MAT observed the cargo arm fracture. He immediately notified the oil spill response team located at the Mobil refinery and activated the terminal oil spill response plan. He stated that the incident occurred so rapidly that he did not have the time for any further discussion with the vessel until well after the event.

2.6 Bureau of Meteorology

2.6.1 Background

BoM (The Australian Bureau of Meteorology) is the agency responsible for weather data collection, forecasting and dissemination. BoM broadcasts high seas and coastal weather information four times daily by text and by data via the Inmarsat system as well as on designated MF and HF radiotelephony frequencies and also posts them on its website. Weather information may also be accessed on the BoM website by entering the 'Marine Weather' webpage on its website, then selecting the appropriate State.

Weather warnings are also forwarded directly to individual subscribers (government and non-governmental agencies and private organisations) by email and by land-line facsimile. The subscribers can also subscribe to local (bays and inland) weather information including synopsis, forecasts and warnings.

BoM's webpage provides information on how to subscribe to receive its various weather bulletins. The other terminals in the Ports of Melbourne and Geelong had subscribed to receive by facsimile and email, all local marine weather broadcasts as well as inland strong wind warnings.

2.6.2 Weather reports

At about 0505 on 21 August BoM issued a gale warning for Victorian waters and forecast northerly winds between 20 to 30 knots tending northerly to 40 knots during the morning. At 0522 BoM Melbourne office issued a 'high seas weather warning' that a front with vigorous northwest to southwest air stream was moving east at about 35 knots. The bulletin forecast north to north-westerly winds 30 to 40 knots within 300 nautical miles east of the front shifting to west south-westerly 30 to 40 knots during the day.

At about 0912 on the day of the incident BoM issued a 'Top Priority' local squall warning stating that a thunderstorm was expected to cross the port within the next hour, bringing with it wind squalls up to 60 knots. The warning was faxed to all local

subscribers of 'BoM local squall warnings' and was also posted on its website, in the Victorian marine weather webpage a few minutes after the faxed warning was issued.

As this was deemed to be a localised phenomenon, BoM did not consider it necessary to transmit the warning via the Inmarsat system.

2.7 Coast Radio Melbourne

In accordance with Federal and State Inter-Governmental agreements, each State is responsible for broadcasting weather reports for coastal and local waters by VHF radio. CRM receives weather information from BoM by email and by facsimile, which it then broadcasts to all stations via radiotelephony using VHF channels[12] 16 and 67.

CRM broadcasts weather bulletins (synopsis and forecast) for waters in and around Port Phillip and Westernport every six hours. The bulletins are broadcast on VHF channel 67, preceded by an announcement on channel 16. If an 'urgent' or 'top priority' warning is received, CRM will broadcast it immediately.

The top priority local squall warning issued by the BoM at 0912 was broadcast by Coast Radio Melbourne at 0915 on VHF marine radio channels 12, 16 and 67. CRM does not usually make weather announcements on VHF channel 12 however in this instance, it was reported that due to the severity of the warning and as there was no radio traffic at that time on channel 12, the CRM officer decided to announce the top priority warning on VHF channel 12 as well.

2.8 Environment

2.8.1 Synopsis

During the morning of 21 August 2009 the sky was cloudy (7/8th cloud cover) and the visibility was more than 10 nautical miles. The temperature was about 15 degrees Celsius and the atmospheric pressure was about 995 hectapascals. The wind was northerly about 20 knots with occasional gusts between 27 and 30 knots.

At about 0950 a squall line of heavy showers and isolated thunderstorms associated with a strong cold front moved through Port Phillip, moving eastward at the rate of about 40 knots. Wind speeds were enhanced by a gust front associated with these thunderstorms. Immediately behind the front winds shifted to north-westerly and increased to about 45 knots gusting to about 60 knots.

At around the time of the incident wind sensors at St Kilda Breakwater recorded 57 knot winds and at Fawkner Beacon 59 knot winds.

2.8.2 Formation of a squall

Mid-latitude squall line thunderstorms are observed regularly over parts of southern Australia and sometimes produce severe weather. A squall is a sudden, sharp increase in wind speed which is usually associated with active weather such as rain showers and thunderstorms. A squall line occurs when thunderstorm cells are arranged in long lines (frontal or non-frontal) and adjacent cells are so close together they form line thunderstorms. Hence the term 'squall line'. Such storms are often accompanied by strong surface wind gusts.

[12] VHF channel 16 is the international distress and calling frequency for vessels on the high seas and VHF channel 67 is the supplementary distress and calling frequency in Australia and on which weather reports and forecasts are broadcast.

Squall lines develop initially along a linear lifting mechanism[13] which may be a front line but is more likely to be a pre-frontal trough. Squall lines can exist for several hours if the lifting mechanism remains present. The strong winds at the surface may be due to downdrafts from thunderstorm outflows or stronger winds aloft being mixed down to the surface.

The BoM have advised that the prediction of strong wind gusts associated with thunderstorms is made from assessing the environment in which the thunderstorms form. Forecasters look for existing thunderstorms developing along a line but predictability at a given location depends on when and where the squall line first forms in relation to that location. Therefore, prediction of the exact location of individual thunderstorm cells is not possible ahead of time.

Once detected, thunderstorms are monitored in near real-time using radar, with predictability sometimes out to just a few hours. In this incident, the BoM advised that the squall line was detected about one hour prior to it passing over the Port of Melbourne.

Advice obtained from BoM and Melbourne VTS indicates that the Port of Melbourne experiences squall lines with strong winds above 60 knots several times a year.

2.9 Port of Melbourne Corporation

POMC (The Port of Melbourne Corporation) is the port manager for the Port of Melbourne. PoMC is the owner of all land within port boundaries and is responsible for the port waters of Melbourne, pursuant to the *Port Services Act 1995* (VIC). In accordance with the *Marine Act 1988*, the port manager must appoint a harbour master.

All shipping movements within port waters are controlled by the harbour master through the Melbourne VTS located at the Shipping Management Centre. The *Act* provides the harbour master with a broad range of powers to carry out his functions, with regard to the safe navigation of vessels entering, leaving and transiting port waters including the time and manner in which it is done and how they may be anchored or secured.

In the interests of safety, Melbourne VTS will routinely broadcast safety information regarding vessel movements on VHF channel 12. In accordance with the Harbour Master's Directions, all vessels in the Port of Melbourne are required to maintain a listening watch on this channel however the Directions also state that vessels at anchor should "ensure a listening watch is maintained on VHF channel 16 for weather bulletins from Coast Radio Melbourne".

The harbour master also has the authority to control and direct the position and manner in which a vessel may be anchored or be secured, as well as the time and manner of the taking in or discharging from any vessel of cargo, stores, fuel, fresh water and water ballast.

Melbourne VTS subscribes to all BoM weather bulletins and had received the top priority squall warning faxed by BoM at 0912. It is not within the scope of service for Melbourne VTS to broadcast weather information; however, when requested, the VTS will provide weather information to vessels and terminals.

The VTS will also broadcast 'urgent' and 'top priority' warnings if they find that the CRM officer is not on station or if there is some delay on the part of CRM in broadcasting the warning. In this incident, Melbourne VTS was satisfied that CRM immediately broadcast the top priority warning by VHF radio.

[13] Any phenomenon that causes surface air to rise.

There is no recorded evidence that Leyte Spirit contacted Melbourne VTS prior to the incident. When the VTS was informed of the oil spill by a passing vessel, the VTS officer attempted to contact Leyte Spirit first by VHF channel 12. When Leyte Spirit did not reply after two calls, the officer switched to VHF channel 16. The vessel's master replied to Melbourne VTS on channel 16 and reported the incident.

2.9.1 Tugs

There are two tug operators in the Port of Melbourne, each with two tugs. Each operator has at least one tug in operational readiness for immediate deployment.

On 21 August 2009 there were two tugs on standby, not engaged in any other operations. Melbourne VTS have advised the investigation that had Leyte Spirit requested the assistance of tugs, the VTS would have despatched the tugs with the highest priority and suspended other operations, except those beyond the point of abortion.

In such a situation, it is normal for the VTS to permit the tug to proceed over the speed limit provided that the master felt it was safe to do so. In this incident, Leyte Spirit requested the VTS for tug assistance at about 1000. The vessel reported that one tug arrived at the vessel at 1025 and the second arrived at 1031.

2.10 Industry reference manuals

2.10.1 Effective Mooring Guidelines

In its publication 'Effective Mooring Guidelines', the OCIMF advises that the most commonly used criteria when designing a mooring system for a particular vessel is a wind speed of 60 knots acting from three directions[14] – head (or stern) wind, 45^0 off the bow (or the stern) and a beam wind - applied approximately 10 metres above sea level while the vessel is secured to a conventional berth.

It follows that some lines should be in a longitudinal direction (spring lines) and some lines in a transverse direction (breast lines). Spring lines will restrain a vessel in two directions (forward and aft) whereas breast lines essentially restrain the vessel in only one direction (off the berth). Mooring patterns will also incorporate head and stern lines that are orientated between a longitudinal and transverse direction.

The publication also advises that (gradient) wind velocity increases with height above sea level. In the absence of any obstruction or friction, a 60 knot wind measured at 10 metres above sea level could be 75 knots at a height of 30 metres though only about 30 knots at a height of two metres above sea level.

With regard to the design of mooring winches, the publication advises that the brake is a static device for holding a line tight and acts as a safety device in case the line load becomes excessive. For manually tightened brakes, the degree of tightness achieved is directly related to the strength of the person and the technique used. Brakes should have a holding capacity of about 60 percent of the breaking load of the line, which will permit slippage before the line breaks.

Occasionally unanticipated changes of load caused by extreme winds, waves or tide may cause the brakes to render and the vessel to be at risk of moving off the berth. However, as the holding power of a brake is always greater than the heaving power, once the brake starts to render it is not possible to heave in unless the forces causing the render are reduced.

[14] The vessel is subject to each wind direction separately to determine the maximum amount of force exerted on each line.

With regard to holding capacity, the publication states that once a line load is applied to the drum, the brake band will stretch reducing the load on the brake controls. For this reason a conventional screw brake can be easily re-tightened when the mooring line is under high load, even if it was set hard originally. This means that there is no way to determine the proper hand wheel torque required once the winch is subjected to a high line load. The danger exists that under worsening environmental conditions the brakes can be re-tightened to the point where the line may part before the brake slips.

2.10.2 International Safety Guide for Oil Tankers and Terminals

In its guidelines, ISGOTT (International Safety Guide for Oil Tankers and Terminals) states that occasionally, severe weather may place excessive strain on the moorings with consequent risk of mooring line failure and movement of the tanker in or off the berth. In such circumstances, tugs can perform a very useful function in holding the ship against the berth in order to reduce the strain on the moorings. In such circumstances, cargo operations should be immediately suspended, hoses or loading arms should be disconnected and engines placed on standby.

ISGOTT also states (in part) that "The terminal representative should alert the tanker to any forecast of adverse weather conditions which may require operations to be stopped or loading or discharge rates to be reduced. In some instances, necessary information may be provided by third parties in the immediate vicinity of the ship."

ISGOTT further states that the terminal should establish parameters for controlling or stopping cargo operations, based on maximum wind and swell criteria in relation to the design of the berth and its equipment, which could include:

- Wind speed/direction and the effect on hard arms, mooring integrity and gangways;
- Swell effects at exposed terminals on mooring integrity or gangway safety.

Any such limitations should be discussed with the tanker and be clearly understood by both parties before operations commence and should also be recorded in the ship-shore safety checklist.

2.10.3 Ship-shore safety checklist

ISGOTT provides a template ship-shore safety checklist based on safe practices widely accepted by the oil and the tanker industries. The checklist has been adopted as a standard document by the OCIMF and therefore, by all oil companies in Australia. It defines the individual and joint responsibilities of the tanker and the terminal and requires each party to confirm that the other party has complied with its individual responsibilities.

The checklist covers issues such as the safe procedures for discharge of bulk oil by the vessel and safe receipt of the cargo by the terminal, methods of communication, watchkeeping arrangements, procedures for safe mooring and gangway and emergency procedures. The checklist also provides for wind speeds at which cargo operations should be stopped and the cargo arm disconnected. The criteria for stopping cargo operations, disconnecting hose arms and vacating the berth should be recorded in the checklist.

The investigation noted that the ISGOTT checklist did not provide for how local weather information would be accessed and shared by the parties, or the time required for disconnection of the shore cargo arm from the manifold. It also did not address conditions or wind speeds at which the vessel should consider leaving the berth, or to consider other measures to hold the vessel alongside the berth.

2.11 Dynamic Mooring Study

Post incident, a (computer modelling) Dynamic Mooring Study of Leyte Spirit's mooring arrangement was conducted by Tension Technology UK, to confirm the holding power of the mooring winches and the point at which they would start to render.

The study used actual vessel data and berth data including physical features of the vessel and mooring equipment holding power and input the actual environmental conditions as reported at that time. No allowance was made for kinetic friction, which would occur once the brakes started rendering.

For the first 20 minutes of the study, the wind speed applied had a mean value of 30 knots and a peak of 44 knots. At the 20 minute mark the wind speed was increased in arbitrarily chosen steps to 68 knots (in line with the peak observed wind speed by the vessel) and the mean direction was shifted to the beam (in line with the reported shift in wind direction).

It was found that at the 21.5 minute mark, the tension in aft breast lines (11 and 12) reached 48 tonnes and they started to render (Figure 12). Once these lines started rendering, the strain on the other lines was increased. The stern lines rendered next (15 and 16, then 13 and 14), followed by the aft springs and then the forward lines.

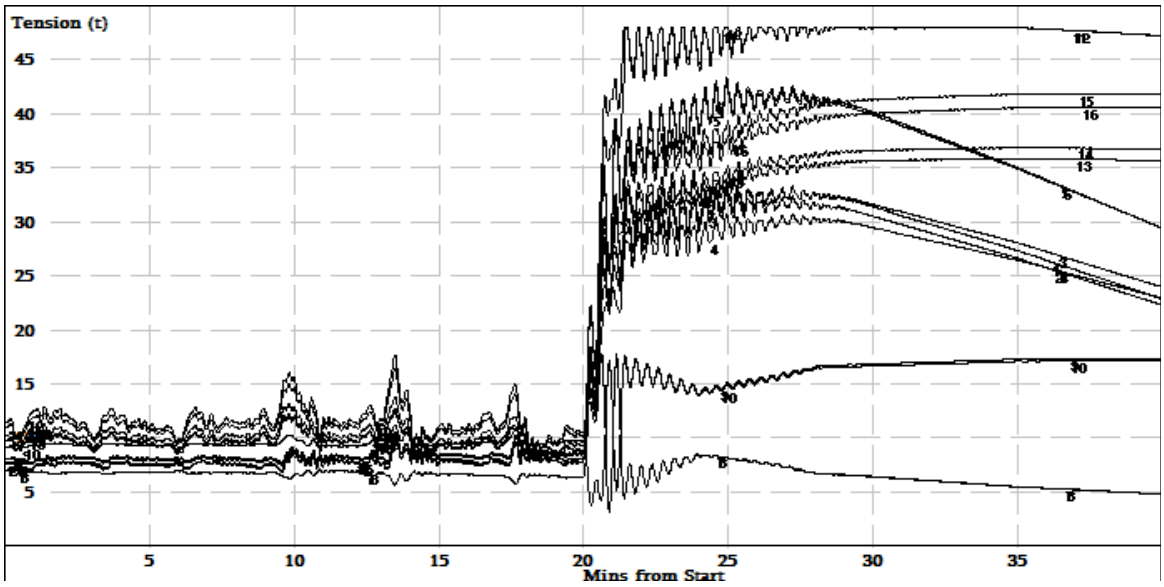


Figure 12 – Mooring line load dynamic response

3. ANALYSIS

3.1 The incident

The vessel and the terminal separately received forecasts of 30 to 40 knot winds during the morning but there is no evidence to suggest that the two parties discussed the possibility cargo operations would have to cease sometime during the day. Neither party was aware of the top priority warning issued at 0912 by the BoM and broadcast at 0915 by CRM and therefore were not prepared for the change in weather.

When the squall arrived, there was a sudden change in the wind speed and direction, which exceeded the operating parameters of the vessel's mooring system, causing the mooring lines to render. As neither the vessel nor the terminal had taken any prior precaution, once the squall arrived there was nothing that they could do to hold the vessel in position.

Just prior to the incident, Leyte Spirit was discharging crude oil at the rate of about 600 litres per second. Given the speed with which the situation changed, only the action of the master and subsequently the chief officer prevented what may have been a major oil spill incident.

The vessel was not made aware of the time required for the shore crew to arrive at the vessel to disconnect the cargo arm. The vessel is fortunate that in this incident the cargo arm pipe fractured on the shore side of the manifold rather than the vessel's pipeline fracturing or its manifold getting uprooted from the foundation, which may have resulted in significant damage to the vessel.

3.2 Accessing weather reports

The terminal was unaware of its option to subscribe directly to BoM for weather forecasts. They were aware that local weather information was broadcast by CRM on VHF radio but the terminal was not fitted with a VHF radio and they were unaware of the VHF channels on which local weather was broadcast.

BoM posted the top priority warning on its website, on the page pertaining to Victorian marine weather forecasts. The website did not have an 'alert' message on its home page. Therefore, unless the MAT was actively monitoring the appropriate webpage, the warning would not have been seen.

BoM action to issue the warning locally (by land-line facsimile) instead of broadcasting it to all stations (Inmarsat) on the high seas was reasonable, as this was a localised event only. However, even if the warning had been broadcast by Inmarsat, it is not certain that Leyte Spirit would have received the warning in time as weather reports were required only to be sighted by the duty officer going off watch, which in this case would have been at around 1200.

Had the ship-shore checklist provided for the accessing and exchange of weather information then it is reasonable to assume that the terminal and the vessel would have discussed arrangements to source and exchange local weather information. Besides referring to the ALRS, the easiest method of obtaining information would have been for either party to contact the local waterway/port manager, in this case Melbourne VTS.

3.3 Leyte Spirit

3.3.1 Vessel actions

For vessels alongside berths, it is the master's responsibility to comply with the harbour master's directions in respect of being properly moored, taking into account the layout of the berth and the vessel's characteristics in the prevalent and forecast weather conditions.

It is possible that the crew's apparent lack of familiarity with the port and its local conditions may have been a factor in them not being aware of local weather variances and that squalls could occur with little warning.

The usual practice for a vessel once berthed is to:

(1) tune its Inmarsat telex and facsimile equipment to automatically receive weather reports and to check for messages once or several times per watch, depending on the impending weather; and

(2) maintain a VHF radio listening watch on the designated port working channels.

The evidence indicates that Leyte Spirit followed usual vessel practice in port and expected to be provided with local weather reports from the terminal, in accordance with ISGOTT guidelines. It is possible that the vessel misinterpreted Harbour Master's Direction and expected weather information to be broadcast on VHF channel 12

Had the vessel referred to the ALRS, they would have been aware that local weather information was broadcast on VHF channels 16 and 67. Notwithstanding, in this incident had the vessel been actively monitoring VHF channel 12 as it was required to do, the vessel should have heard the announcement of a top priority squall warning to follow.

The vessel did not discuss among themselves the probable implications to cargo operations if the wind increased despite receiving the early morning weather reports. The evidence indicates that the VHF radio announcement on channel 12 made at 0915 was not heard by the vessel.

Had Leyte Spirit obtained warning of the approaching squall and thunderstorms at 0915, there would have been sufficient time to stop cargo and for the terminal to drain the lines and wash them. At that point here would also have been sufficient time to request the assistance of the port's tugs with the intent to hold the vessel alongside. However, in the absence of tugs there was nothing that the vessel could do to prevent the cargo hose arm from fracturing.

3.3.2 Mooring system

The rendering of the mooring lines is a desired outcome for the safety of the vessel. If the vessel had parted its lines, its movement would have become 'unrestricted' and it could possibly have grounded with considerable damage to the vessel and possible loss of cargo. The evidence indicates that the vessel crew operated the winches and their brakes correctly and in accordance with accepted practice.

Leyte Spirit's mooring arrangement was in accordance with the recommended practice for vessels moored to a typical tanker terminal. The mooring winches were designed to withstand winds up to 60 knots. The dynamic mooring study conducted post incident established that the vessel lines started rendering when the wind speed reached 68 knots and the tension on the aft breast springs reached 48 tonnes.

At the moment when the vessel started moving off the berth, the anemometer indicated a wind speed of 68 knots. Therefore, it is reasonable to assume that the winch brakes were appropriately tightened prior to the incident, to a holding power of 48 tonnes.

3.4 Gellibrand Terminal

Although the terminal was satisfied that local weather information was being broadcast by CRM, they still had a responsibility under ISGOTT, to ensure that the vessel had access to the information. At the very minimum, the terminal should have informed the vessel of the VHF channels for local weather broadcasts however, the terminal was unaware of such information.

The terminal had systems in place to monitor the prevailing weather and to take action in case of adverse weather but it did not have systems to obtain weather forecasts directly from the BoM, except through the website. In addition, the terminal did not have guidelines for the MAT to actively monitor the BoM marine weather webpage.

Had the terminal been able to obtain early warning of the impending squall, either by facsimile or by VHF radio, it is probable that they would have ensured that cargo operations were stopped and the lines purged. At that stage, there would also have been sufficient time to discuss with the master the ordering of tugs.

3.5 Harbour master

The harbour master has a function to provide for the safety of the port and the vessels using the port including the time and manner of taking in or discharging of cargo from any vessel. Among other factors, knowledge of the forecast weather conditions is important to ensure precautions are taken to maintain safety.

Whilst it is the master who has a duty of care to ensure that the vessel is properly berthed and it is the terminal's responsibility to ensure that their asset is protected, it is a reasonable expectation that the harbour master ensures that berthed vessels have access to all weather bulletins issued by the BoM and CRM for the port.

It is possible that vessels adhering to the Harbour Master's Directions may be confused into believing that weather information would be automatically broadcast on VHF channel 12. In this instance, the top priority squall warning announcement was broadcast on VHF channel 12 for vessels to switch to channel 67, although, under normal circumstances, the announcement is made only on channel 16.

4. CONCLUSIONS

4.1 Findings

1. Leyte Spirit was correctly moored in accordance with the terminal and the vessel's safe mooring procedures.

2. The vessel's mooring equipment complied with the OCIMF operating guidelines and minimum criteria for mooring limits and was found to be in a satisfactory condition.

3. The ship-shore safety checklist does not address monitoring and exchange of weather (including local warnings) information, the time required to disconnect the manifold and conditions under which the vessel may have to vacate the berth.

4. The Harbour Master's Direction requires only vessels at anchor to maintain a watch on VHF channel 16.

5. The Bureau of Meteorology issued the top priority squall warning by facsimile and posted it on its website, when it was detected.

6. Coast Radio Melbourne broadcast the top priority squall warning on VHF channel 67 preceded by an announcement on channels 12 and 16, immediately after it was received.

7. Leyte Spirit did not hear the top priority weather announcement made on VHF channels 12 and 16.

8. Leyte Spirit expected the terminal to provide it with local weather information and the terminal was satisfied that Coast Radio Melbourne was supplying it.

9. Mobil Gellibrand Terminal was not a subscriber to the Bureau of Meteorology weather services and did not have a VHF radio installed.

10. Neither Leyte Spirit nor Gellibrand took any precautionary action after receiving the early morning forecast noting that high winds were expected during the day.

11. Mobil Gellibrand does not permit vessel crew to disconnect the cargo shore arm and the shore hose crew require between two and four hours notice to attend the vessel.

12. At least two tugs in the Port of Melbourne are available for immediate deployment at any time.

4.2 Contributing factors

1. Gellibrand Terminal and Leyte Spirit did not have appropriate systems in place to obtain weather forecasts.

2. Gellibrand Terminal and Leyte Spirit did not take precautionary action after receiving the early morning forecasts of high winds expected during the day.

3. Gellibrand Terminal did not receive and Leyte Spirit did not hear the top priority squall warning issued at 0912 and broadcast at 0915 respectively.

4. A line squall with winds in excess of 60 knots passed over the port.

5. Leyte Spirit's mooring system was not designed to withstand winds above 60 knots.

5. SAFETY ACTIONS

5.1 Safety Actions taken since the event

5.1.1 Leyte Spirit

Following the incident, the vessel owners Teekay Marine Services circulated a Fleet Notice notifying all vessels of the incident, the need to be familiar with the effectiveness of the vessel's mooring system, to be vigilant against unpredictable weather and to stop cargo if the security of the moorings is in doubt.

5.1.2 Mobil Gellibrand Terminal

Since the incident, Mobil Gellibrand Terminal has subscribed to the Bureau of Meteorology facsimile service to receive all weather warnings pertinent to the area. In addition, the terminal is updating its Standard Operating Procedure to:

- Address the length of time required to purge the cargo lines and to disconnect the cargo loading arm;
- Note under what circumstances it may be appropriate for the vessel to vacate the berth;
- Ensure that the vessel is aware of the correct radio channels, to monitor local weather information;
- Ensure that the terminal will make the vessel aware of all weather information it receives.

5.1.3 Melbourne VTS

The harbour master has issued a Direction to all vessels in port waters:

- To monitor VHF channels 16 and 67 for weather information; and
- That Melbourne VTS will on request, provide current and forecast weather reports on VHF channel 12.

5.2 Recommended Safety Actions

Issue 1

The master has a responsibility to ensure that the vessel is safely moored and that it will remain safe for the duration of its stay. Therefore, it is necessary to have access to all local weather forecasts.

RSA 2009010

That Leyte Spirit develops procedures to access local and port weather information and that the 'Standard Operating Practice' manual is updated to:

(1) prescribe the frequency and degree to which weather should be monitored;

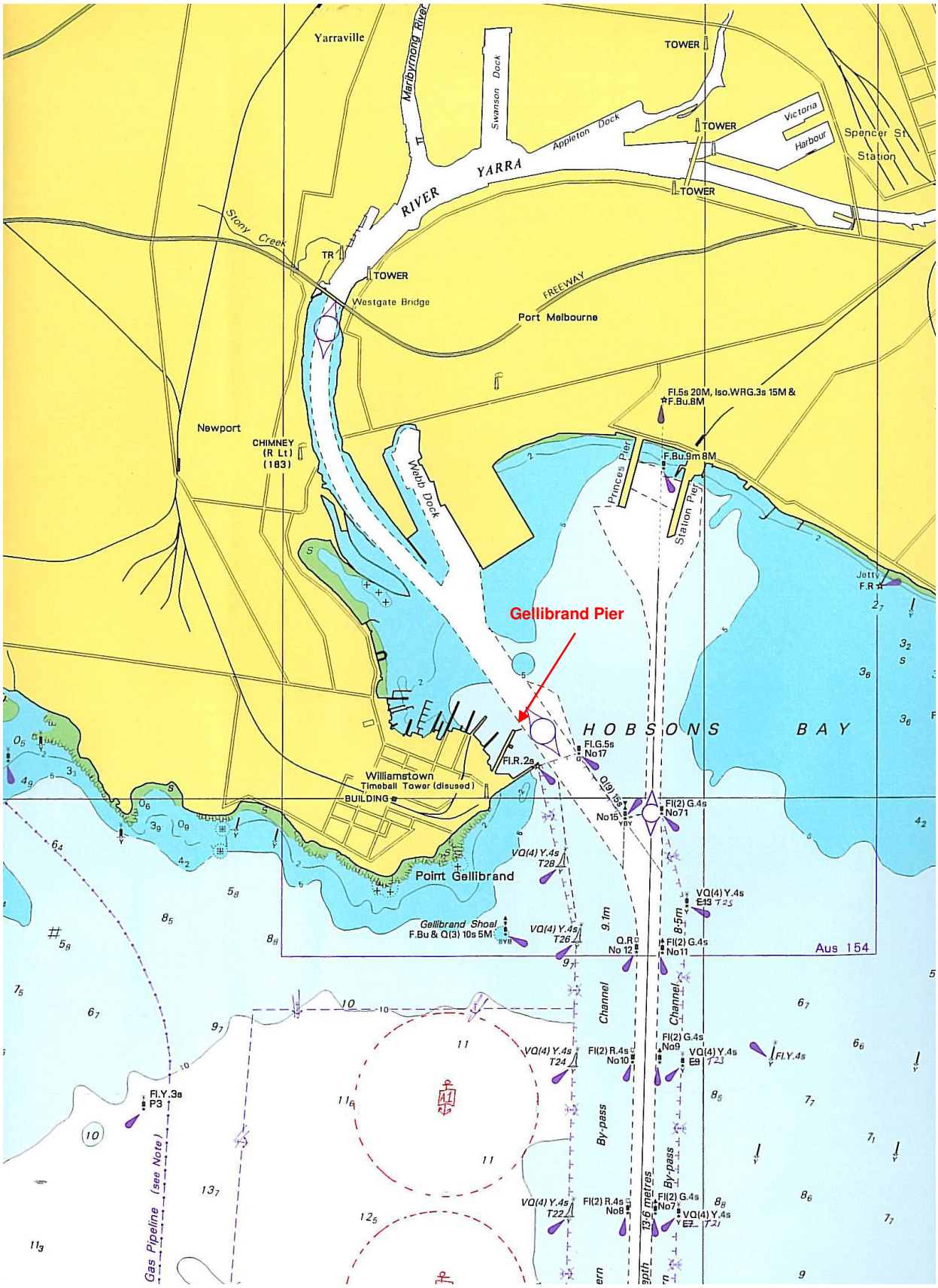
(2) provide guidelines to crew for accessing local weather bulletins.

6. APPENDIXES

Appendix A Vessel Particulars

Name:	Leyte Spirit
Call Sign:	C6LC6
Flag:	Bahamas
Port of Registry:	Bahamas
IMO Number:	9017094
Class:	LR 100A1, Double Hull Tanker ESP, IWS, LI, LMC, UMS, IGS
Builder:	Onomichi Dockyard
Launched:	02 June 1992
Owner:	Teekay Navion Offshore Loading Pte Ltd, Singapore
Length:	244.8 metres
Breadth:	41.2 metres
Depth:	21.6 metres
Draught:	14.418 metres
Freeboard:	6.215 metres
GRT:	57448
Deadweight:	98744 metric tonnes
Engine:	MAN B&W 7S60MC
Horse Power:	17,850BHP at 102RPM // 16,070BHP at 98.5RPM
Propeller:	3-blade single right-hand screw diameter 7150 mm x pitch 4830 mm
Mooring winches:	8 x 15 metric tonnes at 15 metres per minute
Winch brake:	BHC 48 t
Mooring wires:	16 x length 305 metres, dia 36 mm, breaking strength 80/87t
Mooring tails:	Nylon, 16 x length 11m, dia 80 mm, breaking strength 112/126t
Mandal shackles:	Breaking load 120mt
Cargo pumps:	3 x 2700 cubic metres per hour at 150 metres head
Height of deck above keel:	21.79 metres
Height of manifold above deck:	1.89 metres
Dimensions of superstructure:	Height 17.6 metres x breadth 41.8 metres
Dimensions of funnel:	Height 25.2 metres x breadth 8.0 metres
Wind surface area:	3878 square metres (beam) at time of incident

Appendix B Gellibrand Pier Hobson's Bay



Appendix C 0915 Top Priority Squall Warning

IDV26700

BUREAU OF METEOROLOGY
VICTORIAN REGIONAL OFFICE

NEWS FLASH - FOR IMMEDIATE BROADCAST

TOP PRIORITY
Squall Warning

for
Port Phillip and Western Port

Issued at 9:12am on Friday the 21st of August 2009

A line of heavy showers and isolated thunderstorms are approaching from the west and will move across Port Phillip with the next hour and Western Port within 2 hours. Wind squalls around 50 to 60 knots are expected as the showers and storms move through.

0915 / ff.
1048 / ff.

Appendix D 0505 Weather Report

IDT15123
Australian Government Bureau of Meteorology
Tasmania

Bass Strait and approaches forecast
Issued at 05:05 am EST on Friday 21 August 2009
valid until midnight on Sunday

Please Be Aware
Wind gusts can be a further 40 percent stronger than the averages given here, and the maximum waves may be up to twice the height.

IDT1512301

Synoptic Situation
A weak cold front is moving through east Bass Strait. A stronger cold front will cross the Bight to reach far western Bass Strait about 6am Friday before sweeping across to Wilsons Promontory about 2pm Friday and Gabo Island about 8pm Friday. A weak high pressure system will move over New South Wales on Saturday while cold fronts will slip southwards across Bass Strait on Saturday and Sunday ahead of a stronger front on Monday.

IDT1512303
Victoria. Central Coast, Cape Otway to Wilsons Promontory:

Gale warning for Victorian waters between SA-VIC Border and 60nm east of Gabo Island Friday until midnight: Winds: Northerly 20 to 30 knots tending northwesterly 30 to 40 knots during the morning then shifting westerly 25 to 35 knots in the afternoon. Seas: Up to 3 metres increasing to 3 to 4 metres. Swell: Westerly 2 to 4 metres increasing to up to 5 metres during the evening. The chance of thunderstorms until afternoon.

Saturday: Winds: Westerly 20 to 30 knots tending northwesterly 20 to 25 knots around dawn then increasing to 20 to 30 knots around midday. Seas: Up to 3 metres. Swell: Westerly up to 5 metres decreasing below 4 metres from the morning.

Sunday: Winds: Northwesterly 20 to 30 knots decreasing to 15 to 20 knots during the afternoon then tending north to northwesterly up to 30 knots during the evening. Seas: Up to 3 metres decreasing to 2 metres during the afternoon then increasing up to 3 metres during the evening. Swell: Westerly up to 4 metres increasing to up to 5 metres from midday.

Appendix E 0522 Weather Report

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IDV21000
SECURITE
HIGH SEAS WEATHER WARNING FOR METAREA 10
Issued by the Bureau of Meteorology Melbourne
AT 1922UTC 20 AUGUST 2009
GALE WARNING FOR SOUTHEASTERN AREA

PLEASE BE AWARE
Wind gusts can be 40 percent stronger than the averages given here,
and maximum waves may be up to twice the height.

Situation
Vigorous northwest to southwest airstream. Front near 32S130E 35S137E
41S140E 51S139E to low 976hPa near 46S137E at 201800UTC moving east 35
knots.

Area Affected
Bounded by 38S141E 38S160E 50S160E 50S141E 38S141E.

Forecast
N/NW winds 30/40 knots within 300nm east of front, shifting W/SW 30/40
knots west of front, and reaching 35/45 knots west of front south of
43S. Rough/very rough seas. Moderate/heavy swell.

WEATHER MELBOURNE
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