4 Case Studies

4-1. Crew Claims

Example of Crew Illness

1 Incident Overview

During vessel at dockyard the second engineer (a 58 year old Filipino) had a sudden attack, characterized by symptoms such as vision clouding. He was immediately transported to a clinic at the dock and given a medical examination. He was then transported to a medical facility in town. The examination at this medical facility found that he had cerebral vascular disturbance, high blood pressure, diabetes, and latent hyperthyroidism. He was taken to another medical facility and underwent surgery. He remained at that location and was cared for by his family.
After eight months, he was given permission by his doctor to return to his home country. He was escorted by a nurse and taken back to the Philippines, where he was hospitalized for additional treatment.

2 Cause of Incident

There were remarks on his pre-boarding medical examination that he had high blood pressure and diabetes, but that he was being treated with medicine, and that therefore he was "fit for employment".
The employment period in this case was 10 months, but 14 months had already passed when the symptoms of the above illnesses became evident on-board. His medication situation after the 10 month period is unclear (for example, it is not known how much medication he brought with him, or whether he replenished his supply of medication), but it is possible that because he was on-board for a longer period than contracted, he ran out of medication for his pre-existing conditions, causing them to worsen.

3 Reoccurrence Prevention Measures

Even if an examination comes back as "fit for employment", whenever possible the employment of persons requiring medication to control pre-existing conditions should be avoided, though this depends on the specific pre-existing conditions in question. When employing a person with pre-existing conditions, management of their medication is important. When pre-existing conditions are being controlled with medication, it is likely that the crew member in question will bring medication with them, but the vessel managers (the captain and the employing department on land) must also confirm that the crew member is bringing the medication when they board the vessel, must avoid employing the person for a period of time longer than that for which they have medication, and must not rush to extend the employment period even if the crew member requests an extension.
As part of overall on-board health management, medical examinations which can be performed on-board, such as weight measurement, blood pressure measurement, and diabetes testing, should be performed on a regular basis. There are even some examples of having doctors board vessels to carry out basic medical examinations.

4 Insurance Compensation

Residual disability allowance	US$	66,000
Medical costs	US$	133,000
Repatriation expenses, etc	US$	66,000
Correspondence expenses	US$	7,000
Total	**Approx.US$**	**272,000**

This incident involved over $100 thousand in medical costs, as well as over $60 thousand to replace the crew member.

Example of Crew Injury

1 Incident Overview

During cargo loading, ship rope shift work was being performed on the vessel due to land cargo equipment considerations, and a fore spring mooring line snapped. The severed mooring line struck a chief officer who was working on deck in the legs. The chief officer was immediately taken to a hospital, but both legs suffered multiple fractures, and ultimately the right leg had to be amputated at the knee.

2 Cause of Incident

The rope shift work was using one fore spring line to move the vessel back. There was a 2.9 knot current in the opposite direction of the movement of the vessel. This increased load on the rope is believed to be the cause of the spring line breakage.
The injured chief officer was moving from the stern of the vessel to the bow of the vessel to check the status of the shift work when he was struck by the broken mooring line.

- Mooring line maintenance condition

  As instructed by the vessel ship management company, inspections were performed every 3 months, and mooring lines were rotated or replaced appropriately, as instructed by the shipmanagement company. The conditions of all mooring lines, including the mooring line which broke, had been inspected and found problem-free.

- Personnel placement when performing rope shift work

  There were no problems with personnel station on the vessel when the accident occurred. The mooring line just happened to snap at the same location as the chief officer as he was moving from the aft of the vessel to its fore.

- The bow spring line was not connected as indicated in the shipyard's guidelines, but it is not clear if this resulted in abnormal tension being placed on the spring line (see Figure 1 below).

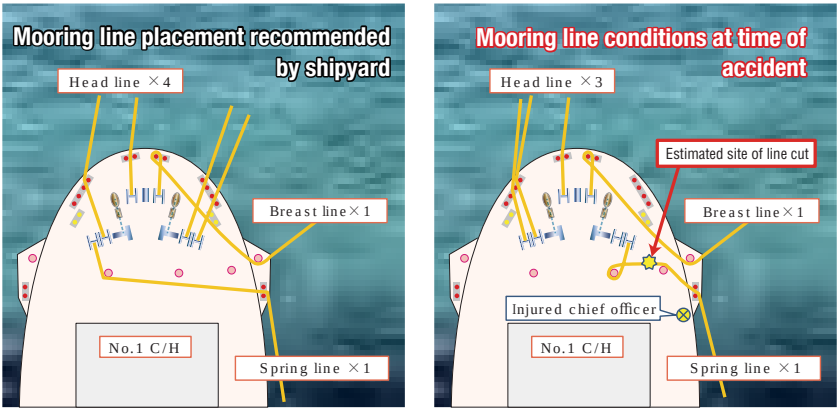


Figure 1. Mooring Line Placement Recommended by Shipyard and Mooring Line Conditions at Time of Accident

3 Reoccurrence Prevention Measures

- Although it was not an issue in this particular case, mooring line inspections should be performed at appropriate intervals. Rope manufacturers do not have standards for when ropes should be replaced, but break testing on 75mm diameter double-braided hawsers used for six years found that the break load was reduced to 65% of that of new ropes. Ropes replacement, like inspection, should be performed at appropriate intervals.
- When performing ship rope shift work, provide detailed explanations of the procedures, etc. to all deck crew, and if any situations arise which differ from planned procedures, work must be immediately halted and the situation re-assessed.
- Situations in which rope shift loads are placed on a single mooring line should always be avoided. It is also important to consider using tugboat support when necessary.
- Inform crew of snap back danger zone
  Notifying and educating crew members about snap back danger zones are also important. The snap back danger zone encompasses a 22 degree cone (11 degrees left of center to 11 degrees right of center), with the point of the point of break, pointing in the direction of the point of restraint. It is also important that crew understand that when mooring lines pass through a fairlead, the snap back danger zone covers a much greater area. (See Figure 2 on the right) For regular shipping routes with identical berth piers at each port, snap back danger zones must be indicated on-deck, but basic training must be provided to crew members to not stand within a 60 degree angle in the direction of the mooring line when reeling the mooring line in.

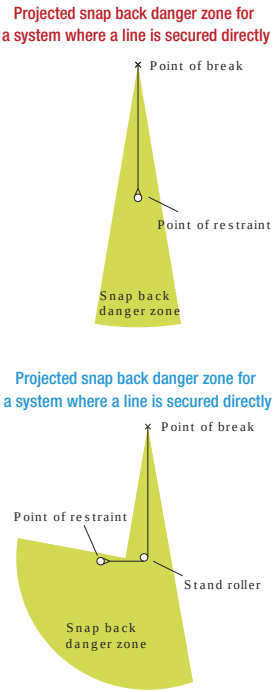


Figure 2. Snap Back Danger Zone

4 Insurance Compensation

Residual disability allowance	US$	137,500
Medical costs	US$	477,500
Repatriation expenses, etc.	US$	27,500
Correspondence / surveyor expenses	US$	66,500
Total	**Approx. US$**	**709,000**

In addition to residual disability allowance and medical costs, this accident also involved significant expenses to pay for a surveyor to investigate the conditions at the time of the accident and correspondence expenses to assist with medical treatment, etc., in the country where the accident happened and in the crew member's country.

4-2. Cargo Damages

Sea Water Damage of Coal

1 Incident Overview

While the vessel (bulk carrier / 25,000G/T) was at sea off the south coast of Australia, it encountered stormy weather (8 on the Beaufort scale). Seawater leaked into the No. 1 cargo hold and damaged the coal inside.

At discharging port, the extent of the damage was investigated, and it was determined that roughly 250MT of seawater had entered the hold. The vessel sailed through stormy weather for one week. During the winter, there is always a high possibility of stormy weather to the south of Australia.

The vessel had folding hatch covers (which opened towards the fore and aft). Evidence was found that sea water leaked in from multiple points on the hatch cover center joint and cover stern and bow areas. There were also several areas of damage on the compression bar, and the drain holes of drain channel were clogged with cargo residue, preventing them from functioning as intended.

2 Cause of Incident

The cause of the leakage of sea water appears to have been problems in the mechanisms used to ensure the water tightness of the hatch cover. This appears to have been exacerbated by the fact that the vessel was at sea in stormy weather for an entire week.

3 Reoccurrence Prevention Measures

- The seals of hatch covers, access hatches, ventilators, and the like must be regularly inspected and maintained to prevent water from leaking into cargo holds.
- When there are forecasts for stormy weather while at sea, shipping routes must be selected based on detailed analysis of weather forecast data obtained in advance (including the possibility of taking shelter from stormy weather). Optimally, shipping route selection should not be left entirely up the vessel, but ground operations should also provide support and guidance.

4 Insurance Compensation

Settlement amount of cargo claim	US$	470,000
Correspondence expenses	US$	180,000
Total	**Approx. US$**	**650,000**

Fresh Water Damage of Bagged Rice

1 Incident Overview

The vessel (bulk carrier / 18,600G/T) was discharging cargo from six of its eight holds. The hatch covers were open during the discharging work. It began raining, so the crew began closing the hatch covers. However, the hatch covers of four of the holds could not be closed, resulting to water damage to bagged rice in those holds. The rain continued intermittently thereafter, and some holds remained unclosed, extending the scope of damage. Ultimately, 90,000 bags (4,500MT, approximately 20% of the cargo) were lost to water damage.

2 Cause of Incident

A fault in the vessel's hatch cover operation hydraulic system made it impossible to close the hatch covers, allowing rainwater to enter the holds. For two of the holds which hatch covers could not be closed, high pressure flexible hose was used as a stopgap replacement for the hydraulic hoses, but it was not possible to close the hatch covers in time.

3 Reoccurrence Prevention Measures

Insufficient day-to-day inspections and repairs to the hatch cover operation system led to the cargo damage incident. This equipment needs to be recognized as important equipment with a direct impact on potential cargo damage.

- Day-to-day inspections

  Hydraulic piping is exposed to the elements on deck, and is prone to rusting. It may also be difficult to inspect, with sections covered by grating. In-depth inspections, therefore, must be performed. Sections of pipes with problems should be replaced as soon as possible.

- Rust prevention measures

  Unlike other pipes, hydraulic equipment pipes are high pressure pipes, making it especially important to prevent external corrosion. Generally, external corrosion is prevented by wrapping the pipes with rustproofing (corrosion-proofing) tape.

- Maintain system functionality

  In addition to piping, control components must also be regularly inspected and maintained.

3 Insurance Compensation

Settlement amount of cargo claim	US$	1,160,000
Correspondence expenses	US$	88,000
Total	**Approx. US$**	**1,248,000**

Off-Spec Damage of Chemical Cargo

1 Incident Overview

The vessel (chemical tanker / 18,400G/T) discharged of part of its cargo of ethyl acetate to a smaller vessel. However, a cargo sample taken from the smaller vessels tanks showed that the water content of the cargo was 4,800ppm instead of the correct amount of 100ppm.

The off-spec cargo (500MT) was discharged to a separate shore tank and resold.

During the discharging to the smaller vessel, the cargo tank next to the tank which was supplying the ethyl acetate (the No. 6S tank) was being cleaned.

2 Cause of Incident

Investigation found that during the cleaning of the cargo tank next to the tank supplying the ethyl acetate (the No. 6S tank), a vessel crew member accidentally connected the cleaning hose to the No. 6S tank, and therefore water for tank cleaning was being pumped into the tank containing the ethyl acetate.

The vessel used flexible hose to connect the end of the fixed cleaning water pipe with the cleaning machine. The sea water/fresh water tank cleaning valves were color coded, but the labels for the cleaning machine were not clearly legible, which is believed to be why the crew misconnected the hose.

3 Reoccurrence Prevention Measures

- Always perform in-depth tank cleaning plan briefings in advance.
- Color code cleaning tube labels and sea water / fresh water valves.
  eg.) Sea water: **Green** Fresh water: **Blue**, etc.
- When using fixed cleaning machines, place labels near the cleaning machine dome. When using movable cleaning machines, place labels near the fixed manholes. Labels must include tank names (as well as clearly indicating if they are port/center/starboard).
- It is also important to lock valves and cocks near cleaning domes for tanks which contain cargo.

4 Insurance Compensation

Settlement amount of cargo claim	US$	95,000
Correspondence expenses	US$	12,800
Total	**Approx. US$**	**107,800**

4-3. Collisions

(Note: Sections 1. Incident Review and 2. Cause of Incident are excerpts from the Marine Accident Investigation Report dated November 25, 2011 by the Japan Transport Safety Board)

1 Incident Overview

An insured vessel ("Vessel A", a 10,833G/T Pure Car Carrier, with a Thai captain and 18 crew members from Thailand, Myanmar, and Indonesia) left Mikawa Port in Aichi Prefecture, headed to Yokohama Port. To adjust its arrival time, it passed north of Izu Oshima Island, and then speed at 17 knots on course <147> towards the relatively uncrowded sea to the east of Izu Oshima Island.

Opponent vessel ("Vessel B", a 4,255G/T Multipurpose Carrier, with a Korean captain and 16 crew members from Korea and Indonesia) was loaded with steel coil from Kashima Port, and was speed at 11 knots on course <240> to the east of Izu Oshima Island, headed to Yosu Port in Korea.

At approximately 02:13 JST the two vessels collided approximately 9 nautical miles to the east of the Izu Oshima Ryuozaki lighthouse. Vessel A's bow was pierced, but fortunately there were no injuries or deaths, and the vessel was able to enter Yokohama Port under its own command. However, Vessel B sank two minutes after the collision, with all 16 crew members going missing. Furthermore, fuel oil leaked from Vessel B, causing pollution damage to nearby aquaculture facilities.

2 Cause of Incident

Both vessels approached on intersecting approaches, but Vessel A was to the starboard of Vessel B, and the bearing change was slightly to the left, so Vessel A attempted to cross in front of Vessel B, from its starboard side to its port side. Vessel B had been slowly turning to the right since 02:03, 10 minutes before the collision, but when Vessel A was approximately 1.3 nautical miles from Vessel B it began turning left, and was turning hard port immediately before the collision. Attempts to avoid collision were unsuccessful, and while attempting to turn in front of Vessel B, the bow of Vessel A struck the middle port side of Vessel B at an almost perpendicular angle. 5 minutes before the collision Vessel B hailed Vessel A by VHF, using its vessel name, determined from AIS, but it has been confirmed that Vessel A did not respond.

The cause of the accident is detailed below.

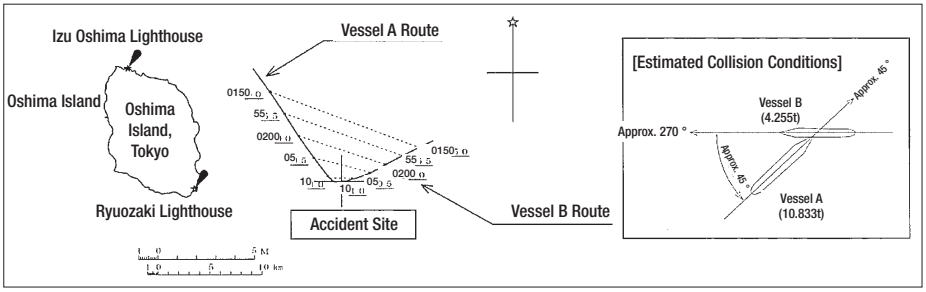
- Insufficient lookout by officer on duty on Vessel A

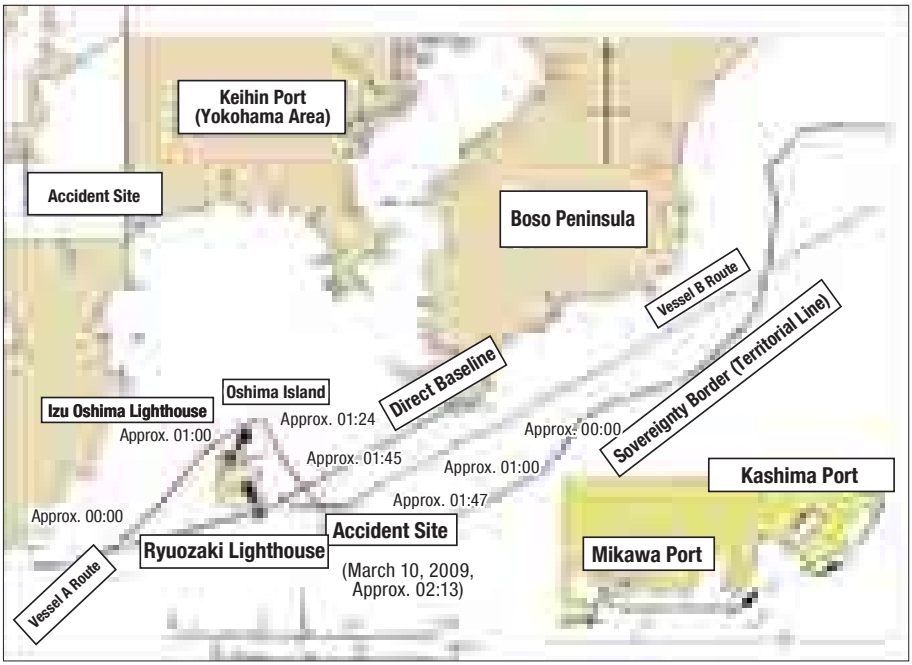
  The Automatic Radar Plotting Aids (ARPA) alarm rang twice, but Vessel A was not constantly monitoring Vessel B's movements. At approximately 02:00, Vessel A spotted Vessel B at a distance of 5 nautical miles, both visually and by radar, but did not maintain a lookout to constantly confirm any bearing changes. Article 17 of the Act for Preventing Collisions at Sea states that when vessels are on intersecting paths, the holding vessel must not turn left unless it is otherwise unavoidable, and Vessel A violated this stipulation.

- Insufficient lookout by officer on duty on Vessel B

  Because it was impossible to hear accounts from crew members, few details are known, but based on AIS records it has been ascertained that Vessel B began slowly turning right from approximately 10 minutes before the collision (at a distance of approximately 4 nautical miles), so it can be said that Vessel B was aware of Vessel A. According to Article 16 of the Act for Preventing Collisions at Sea, the avoiding vessel must maneuver promptly and in a pronounced manner in order to distance themselves sufficiently from the vessel to be avoided. The slow turn to the right appears to be a violation of this stipulation.

Based on the above, collision liability was determined to be shared 50:50, and resolution negotiations began.





(Source: Japan Transport Safety Board)

3 Reoccurrence Prevention Measures

As discussed earlier, almost 100% of collisions are due to human error. This case required officers on duty on both ships to use radar, visual contact, ARPA, etc., to constantly monitor the movements of the opponent vessel, and required the avoiding vessel (in this case, Vessel B) to take early and pronounced avoidance measures. If the holding vessel had doubts about the actions being taken by the opponent vessel, it needed to use whatever means at its disposal (VHF / whistle / cooperative action to prevent the risk of collision before it becomes critical, etc.) to avoid the collision.

4 Insurance Compensation

[Vessel A Insurance Compensation]

Compensation for deaths of crew members on opponent vessel	US$	313,000
Cost of repairs to opponent vessel (1/4 of repair cost)	US$	119,000
Cost of cleaning oil spilled by opponent vessel	US$	1,115,000
Settlement amount of fishing facility damage	US$	112,000
Lawyer, surveyor expenses	US$	574,000
Total:	**Approx. US$**	**2,233,000**

[Vessel B Insurance Compensation]

Compensation for deaths of crew members on own vessel	US$	1,219,000
Cost of cleaning oil spilled by own vessel	US$	653,000
Settlement amount of fishing facility damage	US$	63,000
Lawyer expenses	US$	104,000
Total	**Approx. US$**	**2,039,000**

4-4. Groundings

1 Incident Overview

The vessel (a 14,663G/T Pure Car Carrier, with a Korean captain and 21 crew members from the Philippines and Indonesia) was in ballast passage from the Port of Singapore to the Port of Busan when it encountered stormy weather and took refuge (anchored) off the coast of Keelung (Taiwan). It began dragging anchor, so it weighed anchor and began navigating to Busan to take refuge from the stormy weather. Approximately 2 hours after resuming navigation, at roughly 22:00, the vessel was struck by large waves and strong winds from the northeast, grounding it on a rock reef approximately 200m from the shore. This caused a crack in the fuel tank, which resulted in an approximately 300M/T fuel oil spill. Luckily, none of the crew members were harmed, but unfortunately the entire vessel had to be total loss.

2 Cause of Incident

As indicated above, the vessel encountered stormy weather off the east coast of Taiwan, and anchored near Keelung to take refuge, but strong winds resulted in anchor dragging. The vessel determined that it would not be possible to remain at anchor, so, taking ship swaying into consideration, the decision was made to set course for the west coast of Taiwan. Approximately 2 hours after setting off, extremely strong winds and large waves from the northeast (wind

speeds of 20m to 25m/sec, wave heights of 3.5 to 4.0m) suddenly pushed the vessel. In the darkness the captain saw white waves, indicating the presence of shallows, to the port side. Recognizing the danger this posed, the captain turned hard starboard, but the pressure of the strong winds and large waves grounded the vessel on the reef.

The direct causes of the accident appear to have been that the captain did not sufficiently confirm the vessel's position, and was insufficiently knowledgeable about the angle with which to receive strong winds, the pressure exerted by strong winds, and potential ship maneuvering when faced with strong winds. Another cause of the accident appears to be that the captain did not make corrective maneuvers until the vessel was already very close to the shore.

3 Reoccurrence Prevention Measures

When faced by stormy weather, the strength of the hull places limitations on the course a vessel can keep and the maneuvers it can take while limiting vessel swaying. Strong winds and large waves can be expected to sweep vessels, so when navigating near coast, special care needs to be taken to avoid drawing near shore. When the ratio of wind speed to vessel speed exceeds 3.7, depending on the angle with which the wind hits the vessel, there will be regions in which vessels cannot maintain course. When the ratio exceeds 6, there will be regions in which vessels cannot change course. It is important, in these conditions, to give sufficient consideration to wind speed, wind direction, and stormy weather avoidance courses, and to establish avoidance plans which do not produce regions in which course cannot be maintained or changed. (For details see Loss Prevention Bulletin Vol. 25: Preventing an Anchor from Dragging and Loss Prevention Bulletin Vol. 32: Preventing Damage to Harbor Facilities and Ship Handling in Harbors PART 2.)

It is also important to frequently check the vessel's actual position, always being aware of the vessel's current position and the leeward pressure exerted on the vessel, and to maneuver the vessel to avoid dangerous conditions. In particular, when navigating near coasts, steps need to be taken in advance to prevent the vessel from being put in danger, such as using sea charts to choose danger avoidance routes and "No Go Areas", based on water depths and the positions of reefs, and to carefully formulate navigation plans.

4 Insurance Compensation

Cost of recovering and cleaning spilled oil	US$	5,577,000
Settlement of fishing facility damage	US$	23,000
Cost of wreck removal	US$	21,877,000
Crew repatriation expenses, etc.	US$	170,000
Other	US$	58,000
Lawyer, correspondence, and surveyor expenses	US$	1,365,000
Total	**Approx.US$**	**29,070,000**

4-5. Damage to Harbor Facilities and Fishing Facilities

1 Incident Overview (see attached figure)

The vessel (woodchip carrier / 38,844G/T) planned to dock at a port in Indonesia to discharge cargo. A pilot boarded when the vessel was anchored and navigated outside the port through a 375m wide channel at D. Slow Ahead (approx. 4 knots) with a 2,000HP tugboat at the vessel's starboard bow, and another at its starboard stern. However, there were two other vessels berthed on the port side pier of the channel, so the effective channel width was approximately 350m or less. A barge was preparing to leave port, facing the port side of the vessel, so the pilot hailed the barge via VHF and requested that it stand by until the vessel had completed its turn round work in the area it planned to turn in (a roughly 420m diameter turn area, approximately twice the length of the vessel). However, there was no response from the barge, which continued on its course to leave the port. The pilot was therefore forced to start its starboard turn, driven by the tugboats, near the exit of the channel, but the vessel lost control when starting rotational maneuvers without slowing, and the bow struck the starboard berth, damaging the fender and its support.
When the accident occurred there was a 3 to 5m/sec northerly wind and almost no current, so external force was deemed to have almost no impact on vessel handling.

2 Cause of Incident

= Pilot handling error =

- The pilot was so concerned with the departing barge that he changed the initial turning maneuver plan and began turning within the channel.
- The pilot should have stopped the vessel before turning.

  Generally speaking, even when a vessel is stopped, the diameter of the turning basin, the area needed for tugboats to turn the vessel, must be twice the length of the vessel (in this case, 400m). The vessel should have avoided the departing barge and then stopped and performed its turn within the 420m turning basin, according to its original maneuvering plan.
- Control failure.

  The actual vessel displacement is unknown, but assuming a displacement of 37,500MT (based on its 8m of draft), if the tug line angle of action were 20 degrees, and it pulled straight back with 2200HP (22tons) of force, given the initial vessel speed of 4 knots, it would take 420m to bring the vessel to a complete stop.
  The thrust of the tugboat, when pulling on a vessel moving at 4 knots, would have an apparent decrease of 60% to 70%, and would be dragged by the vessel, so the tugboat could not be depended on to control the attitude of the vessel (supplement its rotation).
- The tugboats which were being used did not have enough horsepower (additional tugboats were requested, but did not arrive in time).

  General guidelines state that vessels in the class of the vessel in question would require two 3000HP tugboats. The amount of tugboat power required can be calculated using the following formula, based on displacement. This also makes it clear that the two 2200HP tugboats used provided insufficient power.

$$\text{Total required horsepower} = 7.4 \times (DWT)^{0.6}$$

If the displacement were 37,500MT, then according to the above formula the total power required would be 4,108HP.

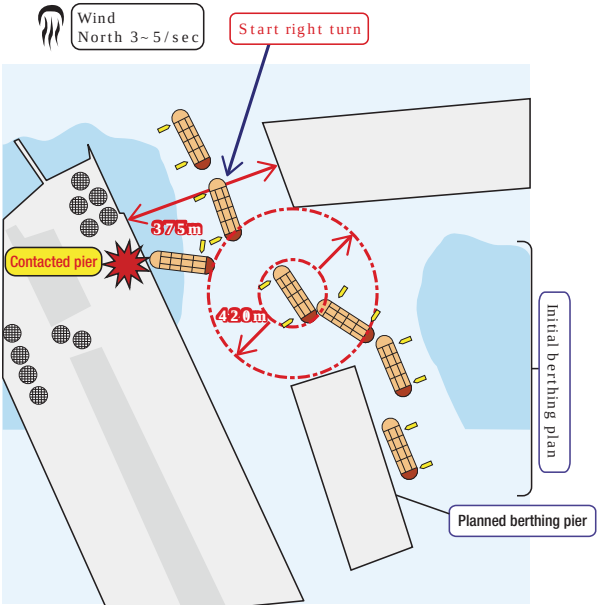
= Vessel captain error =

- The captain did not sufficiently discuss the berth handling approach with the pilot.
- The captain realized that the vessel was moving too quickly when the turn maneuver started at a point which differed from the turn plan, but did not provide advice to the pilot.

Based on the above, there was insufficient BRM between the vessel captain and the pilot.

3 Reoccurrence Prevention Measures

- When a pilot boards where a vessel is anchored before anchor up, it is possible to take time to discuss berthing maneuver plans in depth, so it is important to recognize the importance of BRM and engage in in-depth discussions. It is especially important to closely confirm how much tugboat horsepower will be required.
- It is important not to leave handling entirely to the pilot, but create detailed berthing preparation plans, including calculating how much space and what speeds will be required before entering the port, instead of relying purely on past experience and gut instinct. In particular, it is important to stop the vessel entirely before beginning turning work when turning in confined areas such as narrow channels. (For details see Loss Prevention Bulletins Vol. 31/32: Preventing Damage to Harbor Facilities and Ship Handling in Harbors.)



4 Insurance Compensation

Repair cost of Fender and harbor facility	US$	330,000
Correspondence / surveyor expenses	US$	28,000
Total	**Approx. US$**	**358,000**