3 Large Claim Cause Analysis and Countermeasures

This section provides an overview of the causes of individual large claims and countermeasures used to prevent them.

3-1. Crew Claims

Graph 17 "Detailed Breakdown of Illnesses" and Graph 18 "Detailed Breakdown of Injuries" on page 25 show the causes of crew claims.

There tended to be high incidences of circulatory illnesses, such as cardiac arrests, brain and cranial illnesses such as strokes, cancer, and lifestyle diseases such as high blood pressure, cerebral infarction, and diabetes. While it is hard to pinpoint the direct causes of these illnesses, it is believed that many diseases are caused by visceral fat obesity resulting from unhealthy lifestyles, such as unhealthy dietary habits, insufficient exercise, insufficient sleep, smoking, and excess alcohol intake. The majority of cases of high blood pressure and diabetes, etc., are believed to have begun before boarding, and few are believed to have begun while on board.

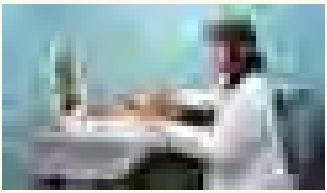
The following preventive measures could help stop these illnesses from occurring.

Crew claim (illness) preventive measures

【Before boarding】

To prevent crew illness claims it is important to strengthen pre-boarding medical examination criteria (selection of medical examination providers) and gain detailed information about medical examination results before deciding whether or not to hire a crew member.

Pre-boarding medical examination criteria vary by the medical examination provider. Therefore crew members may be given failing grades by one provider, but passing grades by another. There have been actual cases where a crew was given a failing grade by one medical examination provider, only to go to another medical examination provider for an examination, pass, board another company's ship, and then suffer from complications to an existing disorder. In the Philippines, we provide the Japan P&I PEME Package, a pre-boarding health examination package. We partner with clinics with sufficient examination equipment in Manila, making it possible to receive health examinations at discounted prices, so we recommend actively using this service. With the adoption of the Maritime Labor Convention: MLC2006, the Medical Certificates for Service at Sea specified in the convention for pre-employment medical examinations (PEME) only contain basic check items, such as the results of hearing, vision, and color vision testing. They



no longer contain detailed health information. However, it is important for vessel owners who will be hiring crew members to have them take appropriate PEME and to check a wide range of items concerning the health of the potential crew member. PEME results can be confirmed using documents other than the Medical Certificate.

【 On-boarding】

- **Perform regular basic health examinations on-board**

As part of general health management, perform regular examinations of basic health items, such as weight, blood pressure, and urine glucose levels. This will make it possible when necessary to have crew members go for more extensive medical examinations at healthcare facilities after arriving at ports.

- **Implement on-board training regarding living environments and promote awareness**

Led by medical advances in recent years, the prevalence of illnesses is shifting from communicable illnesses such as tuberculosis and pneumonia to so-called lifestyle diseases such as cancer, heart disease, and cerebrovascular disease. Lifestyle diseases, as the name implies, are closely tied to lifestyles, not aging, and develop as the result of accumulated health negligence. It is difficult to manage diets when on-board, but it would be best if land management divisions would also implement on-board education and awareness-raising activities regarding living environments, including managing one's own health during break periods.

Next we will look at the main causes of injuries. Slips and falls, bone fractures from collisions with protruding items, injuries from falling into cargo holds or tanks, and injuries when handling vessel equipment, including mooring lines, accounted for more than half of all injuries.
Some causes of these accidents are that fatigue builds up among crew members, and they continue working despite not being in good physical condition, or that they are doing work which they have done frequently in the past, and don't believe that an accident will happen. What is important is to maintain appropriate working environments, have crew members understand the risks involved in handling equipment, and always provide the safety gear required for the various works performed.

The following preventive measures could help reduce inattentiveness and decreased safety awareness, and stop these injuries from occurring.

Crew claim (injury) preventive measures

- **Maintain appropriate working environments**

Safe routes should be ensured, color coding should be used for gratings, manhole covers, and other projecting objects, etc. on deck and in engine rooms, and dangerous areas should be indicated with color coding around mooring winches, which have a relatively high incidence of accidents. Non-slip paint must be applied to areas where slips are likely, such as stairs.
Ladder steps and handrails in and near cargo holds and tanks may be mechanically damaged. To prevent falls, this damage should not be ignored. Instead, regular inspections and repairs should be performed.

These are some representative examples of potential preventive measures, but it is also important to implement accident prevention countermeasures such as the following.

- **Hold meetings before performing work**

  Even for routine work, before performing the work, hold meetings and ensure all crew members are aware of cautions, the risks involved in the work, etc. Imprint in the minds of all crew members that any and all work performed on board will be performed while the ship is constantly in motion.

- **Create written procedures for special work**

  Create written procedures for all special work, such as work in high areas, work in closed areas, work involving fire, the moving of heavy objects, etc., including items which require special attention when performing that work. Have crew members perform the work as dictated in the procedures. Require the wearing of all protective gear necessary for that work.

Psychiatric illness and injuries from fights can both be the results of insufficient communication. Conditions on vessels are cramped, and communication improves interpersonal relationships and is essential for smoothly carrying out duties on-board vessels. When there is insufficient communication, crew members cannot report on or consult about their work, which has an impact on this work. Immediately communicating about issues not only reduces the number of crew member illnesses and injuries, but can lead to safe, accident-free navigation.

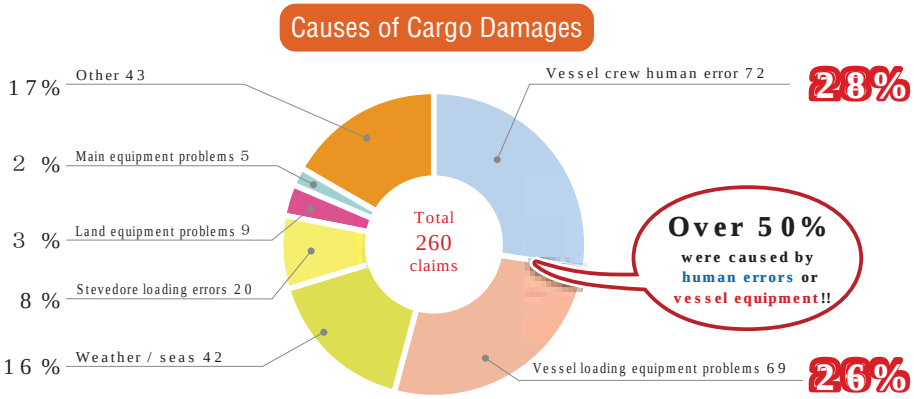
3-2. Cargo Damages

Graph 21 shows the causes of large cargo damages.

Over the seven year period, there were 258 cases of large cargo damages for ocean-going vessels. The graph includes various vessel types, but as Graph 19 on page 29 shows, the number of accidents was particularly high for bulk carriers, general cargo vessels, container vessels, and chemical tankers.

The most common cause of cargo damage was vessel crew human error. For example, this includes improper valve operation, incorrectly setting frozen or refrigerated cargo hold temperatures, insufficient ventilation inside the cargo hold, improper cargo loading/lashing, and other improper management by crew members. Vessel loading equipment problems refer to damage to cargo caused by vessel equipment hardware. This consists of problems resulting from insufficient maintenance of loading equipment, such as the seeping in of fresh or seawater due to the degradation of hatch cover gaskets, the dropping of cargo due to vessel cargo lifting equipment wire ropes degrading and breaking, cargo from adjacent tanks spilling in due to cracks in the walls between cargo tanks, cargo collapses due to twist locks used to secure containers in place rusting and becoming unable to lock, cargo collapses due to deck sockets being damaged or worn and unable to lock, or the like. Weather and seas-related cargo damage refers to environmental factors, such as cargo collapses caused by rough weather, such as typhoons, when there are no problems with the way the cargo was actually loaded.

Human error and vessel equipment hardware problems were the main causes of cargo damage, accounting for 28% and 26%, respectively. Both are causes in which vessel management is at fault, and, combined, accounted for 54% of all cargo damage. Weather and seas accounted for 16%, but there are cases where this damage could have been avoided by gathering weather information, such as weather forecasts, in advance, and building leeway into scheduling to allow the typhoons to be avoided. In this sense, weather and sea cargo damage can also be considered a form of human error, meaning that 70% of large cargo damage was caused by human error or equipment problems.



[Graph 21. Causes of Cargo Damage]

Some cases had multiple causes, resulting in the discrepancy between the number of individual incidents and the total number of incidents.

Cargo damage preventive measures

Considering human error, one factor appears to be leaving cargo management entirely up to cargo loading personnel (primarily the chief officer). Having multiple crew members confirm cargo loading/lashing conditions could significantly reduce the number of cargo damage accidents.

Most accidents caused by vessel equipment problems could be eliminated by properly maintaining vessel equipment. In particular, we received many reports of cargo damage on general cargo vessels and bulk carriers caused by improper maintenance of and hatch covers and their surroundings. Gaskets need to be visually checked, and their water tightness confirmed through periodic chalk testing or hose tests. This confirmation work needs to be part of ordinary vessel work.

3-3. Collisions

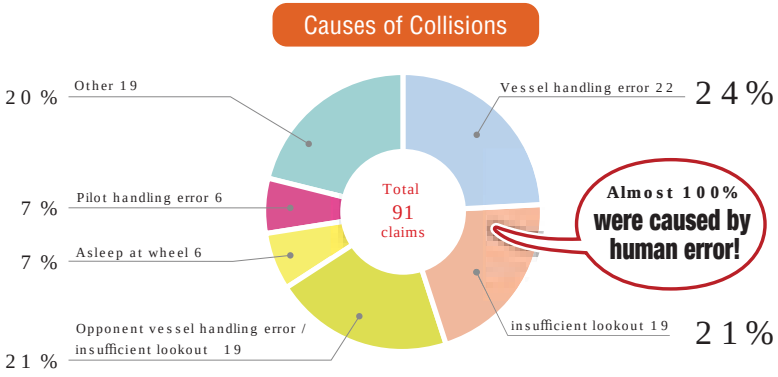
Over the seven year period, there were 73 large collisions.

Graph 22 shows an overview of their causes. Vessel handling error refers to handling not in accordance with the handling methods specified in the Act for Preventing Collisions at Sea. For example, Article 15 (Crossing Vessel Navigation) of the Act states that "When two power-driven vessels are on a course which would result in their paths crossing, and there is a potential of collision, the power-driven vessel which sees the other power-driven vessel on its starboard side must avoid the course of said power-driven vessel. Except when unavoidable, the power-driven vessel which must avoid the course of the other power-driven vessel must not cross in front of said power-driven vessel." With regard to the handling of the avoiding vessel, Article 16 states that "Vessels which are required by this Act to avoid the courses of other vessels must maneuver promptly and in a pronounced manner in order to distance themselves sufficiently from the vessel to be avoided." However, in most cases of collisions involving crossing vessels, either the avoiding vessel did

not notice the other vessel, or it noticed the other vessel but did not engage in avoidance maneuvers at the appropriate time. Insufficient vessel lookout refers to situations when a person on duty was on the bridge but was sitting down and not sufficiently watching the surrounding area, or was doing paperwork or some other work, and therefore was late to notice the other vessel, with which the vessel then collided. Although infrequent, there were also cases where collisions occurred due to lookouts being asleep. These accidents can all be considered human error.

The graph combines handling errors and insufficient lookout when they were problems of the vessel collided with. These accounted for 21% of all collision accidents. When collisions are one-sided, such as when a vessel is struck by another vessel when docked, responsibility is often considered to lie entirely with the other vessel (10:0), but in collisions between two vessels at sea, both are generally considered partly at fault, with each vessel categorized as the "primarily cause" or the "secondary cause". Even when the entered vessel is a holding vessel, Article 17 Section 3 of the Act for Preventing Collisions at Sea states that "When a holding vessel is in close proximity to an avoiding vessel, and avoiding vessel handling alone is seen as insufficient to avoid collision, regardless of Section 1 (Responsibility for Maintaining Course and Speed), the holding vessel must perform handling to avoid collision to the best of its ability." Needless to say, it must warn the other vessel and issue an interrogatory signal. When it recognizes that handling by the other vessel alone will be insufficient to avoid collision, it must perform handling to avoid the collision to the best of its ability. There are many cases where this does not occur, so the holding vessel is considered partially at fault for the collision.

The other 19 collisions (20%) were cases where handling specified in the Act for Preventing Collisions at Sea did not apply, and where Act for Preventing Collisions at Sea, Article 39 "Routine Crew Duties" applied. Routine crew duties refer to those covered by the common sense of persons engaged in maritime activities — that is, experience, knowledge, and practices which any crew member would be expected to know as a matter of course. This is not limited to practices, and therefore is somewhat more broad-ranging than Article 8 Section 1 (Appropriate Vessel Operation Practices) of the Act. A typical example would be that during navigation vessels must avoid anchored vessels.
This, combined with pilot handling errors, makes it fair to say that almost 100% of collisions are the result of human error.



[Graph 22. Causes of Collisions]

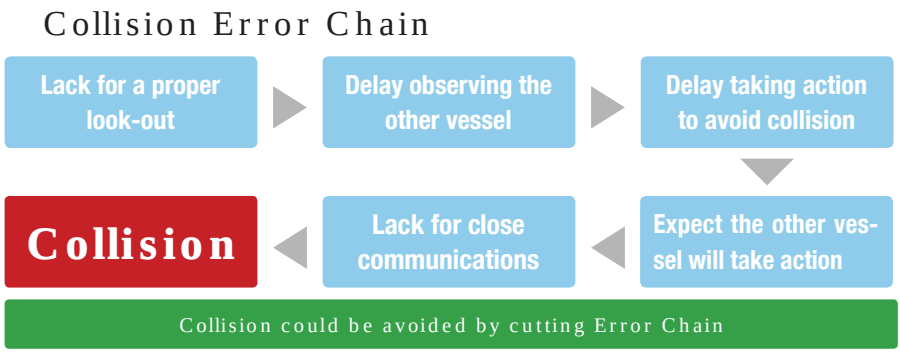
Some cases had multiple causes, resulting in the discrepancy between the number of individual incidents and the total number of incidents.

Collision prevention measures

· Thorough BRM

BRM is becoming a more well-known keyword. BRM stands for Bridge Resource Management. It refers to a safe navigation approach which recognizes that all people make mistakes, and that there are limits to how many things a person can do at the same time, and makes up for these weaknesses and stops chain reactions of errors and mistakes by utilizing bridge teamwork and information, not only through interpersonal communication, but also through device warning signals and procedures, to carry out duties smoothly.

There are almost no maritime accidents which occur as the result of a single error or a mistake (especially in the case of "human error"). In most cases, accidents are the result of many small errors. These "error chains", if not cut, lead to maritime accidents.
Below is an example of a collision error chain.



Unlike with car intersection collisions, in the case of vessel collisions, the other vessel is usually spotted before the collision. However, as is apparent, it is extremely hard for a single person to take evasive measures in order to cut the error chain shown above. For example, it is impossible for one person to turn the vessel while also stopping the engines, while at the same time sounding the horn and hailing the other vessel on VHF. However, there are several chances to avoid collisions before the occur (chances to cut the error chain), and what is important is how to reliably take the right course of action and respond appropriately.

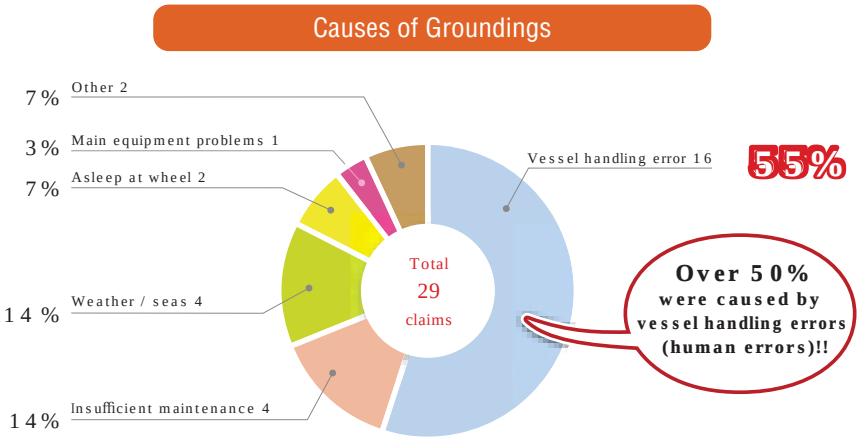
Article 19 Section 5 (Navigation with Limited Visibility) of the Act for Preventing Collisions at Sea states that "turning left when the other vessel is in front of the beam (except when the other vessel is going to be passed by your own vessel)" should not be done unless it is otherwise unavoidable. However, in most cases like this, this regulation was forgotten, and one of the boats turned left, resulting in a collision. An effective way to avoid accidents such as this are for crew members to be repeatedly educated and drilled during pre-boarding training on these basic stipulations of the Act for Preventing Collisions at Sea.

The most important element in avoiding collisions is looking out for other vessels. Always maintaining a lookout is absolute common sense for a vessel operator. It is something so obvious that some see no need for it even to be specified in the Act for Preventing Collisions at Sea. However, the Act for Preventing Collisions at Sea goes back to the basics, focusing on the absolute essentials of avoiding collisions, and Article 5 of the Act specifies the following regarding the vessel operator's obligations to post lookouts. "Vessels must always have appropriate lookouts posted, capable using their senses of sight and hearing, and other methods as appropriate, to observe conditions around the vessel and spot other vessels in order to avoid collisions." It would be fair to say that maintaining a constant lookout would prevent most collisions.

3-4. Groundings

There were 22 large groundings over the seven year period.

Graph 23 shows an overview of their causes. Vessel handling errors, which are human errors, were the most common cause of groundings, accounting for 55% of all accidents. Notable among these were cases where anchored vessels dragged anchor and were grounded in the shallows, or were grounded in the shallows due to insufficient lookout (for groundings, insufficient lookouts are included in vessel handling errors). Groundings caused by insufficient maintenance include holes in cargo holds allowing ballast water to leak in, ultimately resulting in the grounding of the vessel. Situations in which main equipment stopped for some reason, making it impossible to control the vessel and allowing the vessel to be carried by the tide and grounded, are categorized as main equipment problems, but we had only one of these incidents during the study period.



[Graph 23. Causes of Groundings]

Some cases had multiple causes, resulting in the discrepancy between the number of individual incidents and the total number of incidents.

Grounding prevention measures

Prevention of anchor dragging

"Anchor dragging" occurs when the external force placed on hulls by rough weather or tides, etc., exceeds the holding power of the anchor and anchor chain, dragging the hull together with the anchor and anchor chain. When anchor dragging starts and the anchor cannot be weighed, it is seldom possible to use the vessel's motors to control its attitude. Furthermore, the force applied when being pushed downwind makes it difficult to raise the anchor at regular speed using the anchor windlass, and this will greatly increase the risk of the situation, before being able to control the vessel attitude, developing into a maritime accident such as a grounding in the shallows or a collision with another ship.

Accidents when anchored usually occur when the anchor drags and the vessel drifts without holding power, leading to maritime accidents. Below is an overview of the causes of these situations and possible countermeasures.

① It can take some time to realize the anchor is dragging.

- It is important to always have a vigilant bridge watch so that anchor dragging can be detected as soon as possible.

② Be aware that it takes time to weigh a dragged anchor and regain attitude control over a vessel.

- Formulate anchor dragging contingency plans in advance to ensure rapid response.

③ During the period beginning with the detection of dragging to the time full control is achieved over the ship's maneuverability, the vessel may run dangerously close to waters where grounding may occur.

- In situations where a large number of vessels are harbored outside of a port, it may be difficult to secure safe water areas downwind. When this is the case, it is important to give up on attempting anchorage, and instead assume a drift position.

The basic approach to avoiding anchor dragging accidents is summarized below.

① Items to consider before anchoring

- Select an anchoring site which is not prone to anchor dragging (topography, bed material, water depth, etc.).
- Stay sufficiently far away from shallows and other boats so that accidents can be avoided even if anchor dragging occurs.

② Technical measures when lying at anchor

- Be aware of external forces such as wind speed, wind direction, wave height, wave frequency, current direction, current speed, etc.

③ Anchor dragging prediction / early detection

- Understand the relationship between external force and holding power.
- Detect anchor dragging by observing horsing motion (use information from electronic maps, GPS, etc.).

④ Countermeasures after anchor dragging is detected

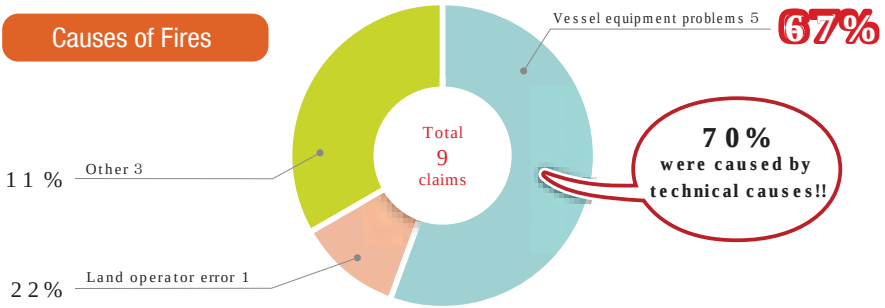
- Weigh anchor and establish maneuverability as soon as possible.
- Weigh anchor during periods of horsing.

For details regarding anchor dragging prevention, see P&I Loss Prevention Bulletin Vol. 25, issued in July 2013.

3-5. Fires

There were 9 large fires over the seven year period.

Graph 24 shows an overview of their causes. Vessel equipment problems, a technical cause, accounted for 67% of all fires. These were primarily fires which began in the engine room, such as fires in exhaust gas economizers, due to combustion failures in main equipment, fires starting from distribution boards, and fuel oil mist from high pressure main equipment fuel tubes falling on superchargers and igniting. There was also one case of shore worker (stevedore,etc.) error, in which a loading worker was smoking in a non-smoking area of the vessel and failed to properly put out their cigarette, resulting in a fire. "Other" includes spontaneous fires from loaded cargo.



[Graph 24. Causes of Fires]

Fire prevention measures

The following fire prevention measures can be implemented.

- **Maintenance and repair of vessel equipment**

  It is important, especially for the prevention of fires in engine rooms, to appropriately maintain equipment and immediately make repairs when oil leaks, etc. are detected. Engine rooms must also be checked for problems.

- **Firefighting equipment maintenance and inspection**

  Inspecting and maintaining firefighting equipment (portable fire extinguishers, firefighting hoses and pumps, etc.) in order to engage in initial firefighting activities is an important vessel duty. Attention must also be paid to the expiration dates, etc. of fire extinguishers.

- **Fire prevention measures when performing work which involves fire**

  When performing welding work onboard, sufficient care must be given to ensuring that hot welded pieces and slag do not fall on or adhere to flammable materials. Hot Work Permit procedures, etc., must be prepared and used to perform preliminary confirmation work.

- **Crew training**

  Firefighting drills must be held at regular intervals as specified in the Mariners Act and SOLAS. Crew members must also perform repeated drills.

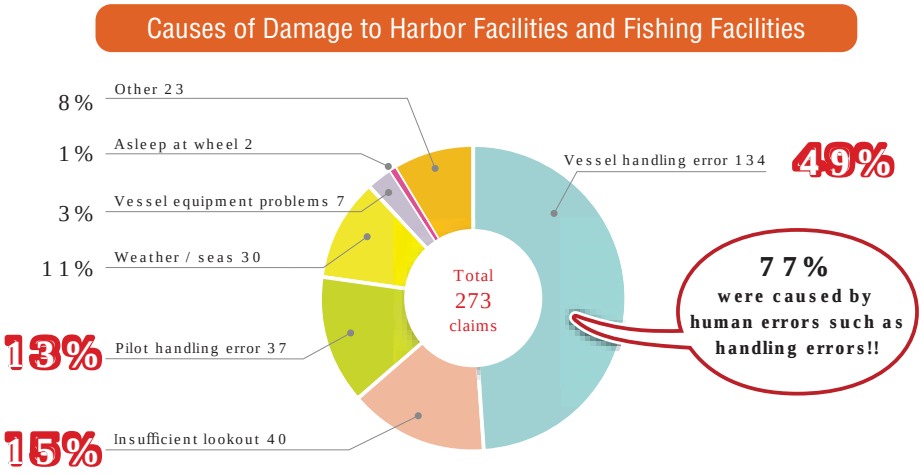
Consideration must also be given to the fact that when initial firefighting efforts fail, there may be situations where it is difficult for vessels to put out fires on their own. Putting people's lives first is a basic principle of all maritime accidents, and in the cases of fires, it is essential to perform headcounts when abandoning ship, or when activating carbon dioxide firefighting equipment. For example, all crew members must be assembled on the bridge, and the captain must confirm that each person is present, and repeat this process several times.

3-6. Damage to Harbor Facilities and Fishing Facilities

Damage to harbor facilities and fishing facilities was second in frequency to crew claims. There were 163 incidents of harbor and fishing facility damage over the seven year period.

As Graph 25 shows, vessel handling errors and insufficient lookout, both human errors, accounted for 64% of all incidents of damage to harbor facilities and fishing facilities. These included numerous examples of damage caused by collisions with piers and shore facilities due to excess speed when berthing, and damage to piers and shore facilities due to vessel maneuvering control failures resulting from delays in issuing instructions to tugboats, or the issuing of incorrect instructions to tugboats.

Accidents which occurred during pilot guidance accounted for a notable 13% of all accidents resulting in damage to harbor and fishing facilities. Most of these consisted of accidents which occurred when entered vessel captains left handling entirely up to pilot, resulting in delayed response. These appear to have been due to insufficient communication between pilots and captains, which is another form of human error. If pilot handling errors are considered to be human errors, human errors account for 77% of all accidents causing damage to harbor facilities and fishing facilities.



[Graph 25. Causes of Damage to Harbor Facilities and Fishing Facilities]

Some cases had multiple causes, resulting in the discrepancy between the number of individual incidents and the total number of incidents.

Prevention measures of damage to harbor facilities and fishing facilities

· Thorough BRM

As with collisions, thorough understanding of BRM is important for preventing accidents caused by human error. In particular, even when a pilot is handling a vessel, the captain must require the pilot to provide explanations of procedures for leaving docks or berthing, and must provide information on the vessel's condition (draft, displacement, motion characteristics, etc.).

At ports where languages other than English or the pilot's native language are used, pilots and tugboats generally communicate in the local language. It is important for officers at the fore and aft of the vessel to report on the tugboat's movement and conditions to ensure the captain understands the vessel's movements.

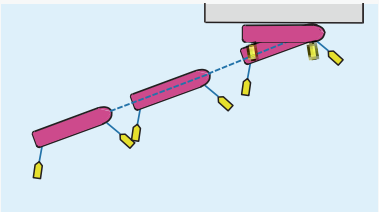
· Understand the vessel's movement capabilities

When leaving dock or berthing, handling is often left up to the experience of the captain or pilot, but they must understand in advance quantitative information such as the minimum stopping distance when tugboats or engine reversal is used for braking, the amount of space needed to turn, the impact of external forces such as wind and currents, etc.

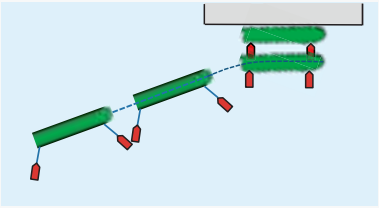
For details, see P&I Loss Prevention Bulletins Vol. 31 and Vol. 32, issued in June and July 2014, respectively.

· Recommend parallel berthing

Even now, for vessels of up to 20,000 G/T, berthing is performed by approaching piers at an angle from their normal, and then after gathering the mooring lines from the bow, using a tugboat to push the stern to the pier. However, for vessels larger than 20,000 G/T, normally the vessel approaches from in front of the berth parallel to the pier's normal, and is stopped at a distance of approximately 1.5 to 2 vessels' widths from the pier. Tugboats and bow thrusters are then used to push the vessel, maintaining its parallel orientation to the pier, until it is berthed. A major ocean-going vessel company which switched to using only this parallel berthing approach, reduced the number of berthing pier collisions by half. While it depends on layout of the particular port, generally the risk of collision with a pier when in the event of speed control loss while using parallel berthing is lower than that of losing speed control when approaching piers head on, and is effective in reducing the number of accidents. Therefore, although specific situations may vary, even for vessels of less than 20,000 tons, parallel berthing is preferable.



Conventional method Under 20,000 G/T

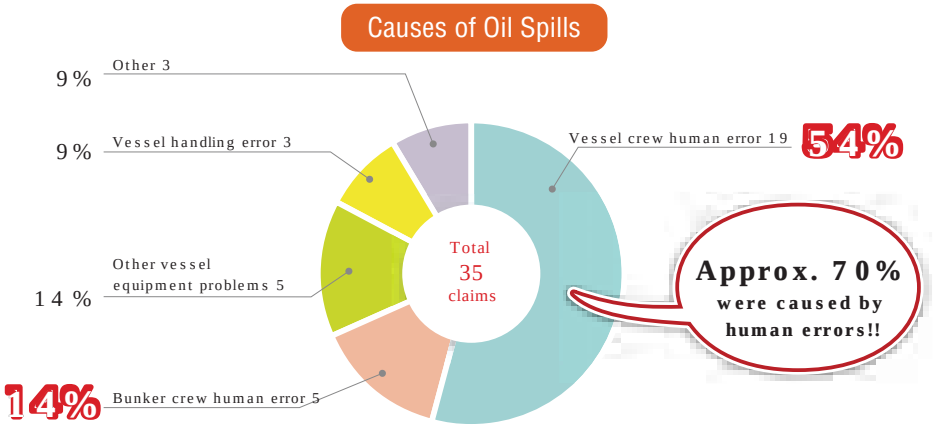


Parallel berthing 20,000 G/T or more

3-7. Oil Spills

There were 23 large oil spills over the seven year period.

Graph 26 shows an overview of their causes. Vessel handling errors, which are human errors, were the most common cause of oil spills, accounting for 54% of all oil spills. For example, these include numerous examples of vessel crew operating tank valves incorrectly when bunkering, causing oil to overflow from fuel oil tank air vent pipes, or of crew believing they had instructed bunker barges to stop pumping fuel but failing to confirm that pumping had stopped, resulting in fuel overflowing from fuel tanks. These were cases of accidents caused by insufficient communication between vessels and bunker barges, and can also be considered human errors.



[Graph 26. Causes of Oil Spills]

Some cases had multiple causes, resulting in the discrepancy between the number of individual incidents and the total number of incidents.

Oil spill prevention measures

· Valve operation error prevention

The following basic policies must be thoroughly reapplied in order to prevent valve operation errors during tanker loading and bunkering.

Before starting loading or bunkering, closing all valves and then lining up from that point is basic operating procedure. Likewise, after all work is finished, all valves need to be closed again, and then valves which must be opened can be reopened.

On consoles, all unused valves should be covered, including hydraulically driven remote control valves, and secured with tape to prevent the covers from coming off, in order to prevent valves from being accidentally opened or closed.
Furthermore, the open/close status of remotely operated valves may not always match what is shown on the control panel. Valves which show as closed on panels may actually be slightly open. Special attention must be paid to cargo related valves, so on-site confirmation must be performed before loading cargo.

・Thorough measurement of actual sounding/ullage

Even when sounding and ullage figures are shown on the console, it is important to confirm them by actually performing sounding and ullage measurement. It is therefore important to assign personnel to perform these measurements.

Summary

Overall, the majority of large claims handled by us appear to be due to human error. Even in the case of vessel equipment problems, one of the causes of cargo damage and fires, appropriate maintenance and management of equipment is one of the important duties of the crew. Given this, educating and managing crew members is a fundamental aspect of accident prevention. Crew members work in cycles of on-board work and breaks, making it difficult for information from their companies to reach them, but education, through pre-boarding briefings and on-board drills, would help prevent accidents.

In particular, there have been many cases on general cargo vessels and bulk carriers in which the gaskets of hatch covers and the like have been allowed to degrade without repair, resulting in major cargo water damage. Waiting until an accident has occurred, or degradation has grown severe, often results in pricey and time-consuming repairs. Equipment management including regular maintenance would reduce these costs.