

Case 1

A crew member who inhaled chloroform gas while checking the condition inside a cargo tank became unable to breathe and died of hypoxia

Outline: While the chemical tanker which departed from Komatsu Wharf in Sakai-Senboku Quarter Section 7 of Hanshin Port was sailing north toward Osaka Quarter Section 1 of the Port, the second officer was found lying inside No.1 cargo tank on the port side at around 12:29, February 7, 2012. Although rescued, he became unable to breathe due to toxic gas inhalation and died of hypoxia.

The Vessel (chemical tanker)

Gross tonnage: 388 tons

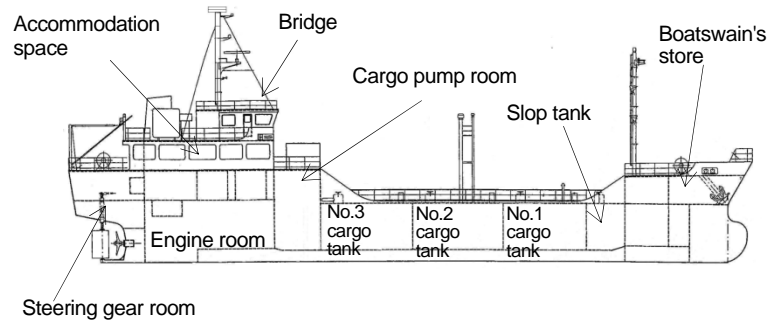
L × B × D : 53.71 m × 8.90 m × 4.40 m

Operator (*1): Company A

Crew: Master, second officer (2/O) and three other members



General arrangement



Events Leading to the Accident

Around 14:05, February 6

After completing cargo unloading, the Vessel washed inside the cargo tanks and transferred washing water to the slop tank.

After that, in order to dry and gas free inside all the cargo tanks after dredging the chloroform (*2) washing water inside the tanks, the Vessel kept sending air for around 13 hours while operating the turbo fan.

Around 12:10, February 7

The Vessel departed from Komatsu Wharf while the master was stationed at the bridge, the chief officer (C/O) and 2/O at the bow, and the chief engineer and the wiper at the stern.

Around 12:25

Sensing a smell of chloroform when 2/O was opening a manhole hatch to check the condition inside portside No.1 cargo tank, C/O told 2/O not to enter the cargo tank, saying that it contained chloroform.

As C/O went to the accommodation space to get oxygen and gas concentration measuring instruments, there remained only 2/O stationed at the bow.

Around 12:29

The chief engineer found 2/O lying with his back against the bulkhead inside portside No.1 cargo tank.

The master attempted to enter portside No.1 cargo tank four times to rescue 2/O. However, sensing danger by smelling gas inside, he got out of the cargo tank in around 30 seconds each time. There was chloroform inside the cargo tank.

Intending to dry and gas free portside No.1 cargo tank, the Vessel sent air inside the cargo tank.

Although hospitalized, 2/O was confirmed dead.

Causal Factors of the Accident

According to the findings that there was a smell of toxic gas inside the cargo tank and a residue of washing water inside the suction well at the time of the accident, it is considered somewhat possible that when sending air, a residue of washing water in the piping was pushed out to return inside the cargo tank.

"Suction well"

A hollow section placed on the quarter side of a cargo tank, designed to absorb cargo and washing water efficiently, which is normally equipped with a tube for absorbing cargo and washing water.



Situation when the chief engineer found 2/O (inside portside No.1 tank)

It is considered probable that there was a danger of a secondary accident.

It is also considered probable that proper measures against emergencies like when an accident has occurred should have been established.

For details, refer to "Other Safety-related Findings" (page 6)

- *1: A person or an organization who carries out schedule management for transporting cargo collected from a shipper, and gives instructions for ensuring the safety of transportation for the sake of the vessel in operation and its lessee.
- *2: A volatile, colorless and transparent liquid with the nature of being nonflammable and poisonous. Its vapor gives a sweet smell.

Inside portside No.1 cargo tank



Ordinary operation procedures

Transfer washing water to the slop tank by means of stripping (*3), followed by another stripping for some of the washing water coming back and building up in the suction well. After ventilating the cargo tank for more than 10 hours, send crew members for going into the tank and dredging the remaining washing water.

*3: Removing any unnecessary things by absorbing cargo or washing water remaining in a cargo tank or cargo piping system

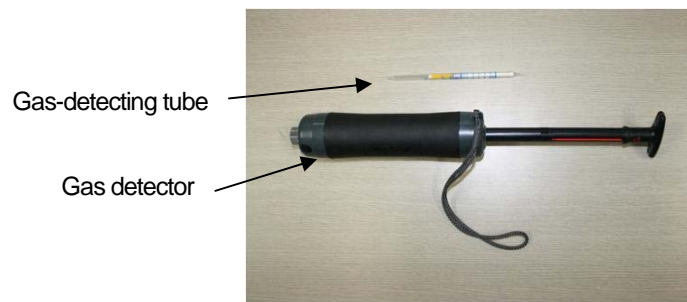
Causal Factors of the Accident

Whether oxygen and gas concentration was measured or not when entering the cargo tank

- ◆ It is considered probable that in spite of replying to C/O's instructions not to enter portside No.1 cargo tank, 2/O did not follow the instructions as he found chloroform washing water remaining in the suction well of the cargo tank, and entered the cargo tank on his own judgment to remove the washing water while C/O went to the accommodation space for getting oxygen and gas concentration measuring instruments (portable and pocketable) (hereinafter referred to as "Both Measuring Instruments").
- ◆ According to the findings that Both Measuring Instruments were not available to 2/O when C/O went for them, it is certain that 2/O did not measure oxygen and gas concentration when entering portside No.1 cargo tank.



Portable measuring instrument



Precautions when entering a cargo tank and instructions on oxygen and gas concentration measurement

1. Concerning the precautions when entering a cargo tank, Company A did not clearly define tank cleaning procedures when washing water was remaining in a cargo tank, although it required making sure of absence of any residual liquid or odor.
2. According to the findings that although Company A explained to the master and C/O about the inability of the portable measuring instrument to measure noninflammable and fire-resistant gas concentration, the crew of the Vessel thought that it could measure the concentration of not only oxygen but also all types of gas including noninflammable ones, it is considered probable that the explanation by Company A was not enough for the crew to understand correctly about the ability of the instrument.
3. According to the findings that in spite of being aware of the requirement to use devices like gas detectors for measuring the concentration of noninflammable and fire-resistant gases, Company A thought that replacing a gas detectors for each cargo tank would be time-consuming and laborious, and instructed the crew of the Vessel to judge the existence of noninflammable and fire-resistant gases by a decrease in oxygen concentration instead of by using gas detectors, it is considered probable that Company A did not give instructions conforming to the notices prescribing standards for transporting dangerous goods by vessels or regulations like coastal tankers safety guidelines.

Causal Factors of Fatalities and Injuries Suffered by Crew

Failure to measure oxygen and gas concentration when entering the cargo tank or the ballast pump room.

It is considered somewhat likely that the casualty did not think it a problem not to measure oxygen and gas concentration.

Entered the cargo tank on his own judgment.

It is considered probable that, assuming that the distance between the upper deck and their working locations such as the cargo tanks was short and the work would not take much time, the casualty entered the cargo tank by judging it possible to work individually even though there might be some smell of a toxic gas.

It is considered probable that although Company A implemented a vessel visiting campaign after the 2010 accident (refer to Case 2 in the next page), and educated and instructed vessels in operation on safety actions, the accident occurred because a crew member of the Vessel (2/O) entered the cargo tank alone on his own judgment without measuring oxygen and gas concentration, underlining that the crew of Company A were not fully acquainted with lessons from the past accidents or the safety actions.

Other Safety-related Findings

With respect to rescue activities in enclosed space,

- ▶ Notify the bridge team immediately, do not act impulsively or do not act on independent judgment, and wait for assistance until the necessary number of people for initiating rescue activities gather.
- ▶ It is not easy to enter enclosed space with a harmful atmosphere to rescue survivors in need of help.
- ▶ Inhaling chloroform gas in a cargo tank disables breathing, causes the condition of hypoxia and makes it difficult to return alive.

In view of the necessity of teaching these precautions, it is considered probable that Company A should have established proper procedures, such as by training, against emergencies like when an accident has occurred.

In Order to Prevent Recurrence (Recommendations)

In view of the result of this accident investigation, the Japan Transport Safety Board recommended the Minister of Land, Infrastructure, Transport and Tourism as follows, pursuant to Article 26 (1) of the Act for Establishment of the Board.

Recommendations to the Minister of Land, Infrastructure, Transport and Tourism

The Minister should instruct coastal shipping companies who operate chemical tankers on the following items.

- (1) The companies should instruct their crew never to fail to implement oxygen and gas concentration measurement when entering enclosed space. They should also visit their vessels on a regular basis to make sure that oxygen and gas concentration measurement has been properly implemented.
- (2) It should be assured that each master has been making a record of implementing oxygen and gas concentration measurement, as well as a record of how many gas-detecting tubes have been purchased, consumed and left unused in case of using gas detectors to measure gas concentration. They should also visit their vessels on a regular basis to make sure that oxygen and gas concentration has been properly measured, by checking records of measurement implementation and gas-detecting tube usage.
- (3) As stated in the coastal tankers safety guidelines and P & A manuals, operation procedures for such categories of work as checking the existence of washing water, removing washing water by stripping, if any, and tank cleaning by drying or gas-freeing should be organized in a plain form so that their crew can understand them easily and check them for confirmation. Such operation procedures should be posted at an easily viewable location close to their working sites.
- (4) Based on the precautions like refraining from acting impulsively or acting on independent judgment in case of emergencies like when an accident has occurred, education and training efforts for the implementation of emergency measures like when an accident has occurred should be made continuously.

The Minister should ensure that in case of conducting an on-site checking, shipping companies should instruct the crew on the measures as mentioned in (1) to (4) above, and make sure oxygen and gas concentration has been properly measured, by checking records of gas-detecting tube usage. The Minister should also make sure, such as by referring to an audit record regularly, that shipping companies have been endeavoring for securing the safety of transportation and improving their business operations.

In view of the result of this accident investigation, the Japan Transport Safety Board also recommended Company A as follows, pursuant to Article 27 (1) of the Act for Establishment of the Board.

Recommendations to Company A

Company A should adopt the following actions as preventive measures against recurrence.

Same as the Recommendations (1) to (4) as mentioned above which were made to the Minister of Land, Infrastructure, Transport and Tourism.

The investigation report of this accident case is published on the Board's website (issued on April 26, 2013).

http://www.mlit.go.jp/jtsb/ship/rep-acci/2013/MA2013-4-2_2012tk0002.pdf