

4. Safety Actions Taken in Response to the Recommendations and Opinions

Actions taken in response to the recommendations made for the fatal accident involving workers on board the cargo ship, Singapore Grace

* For further details of this accident, please refer to the JTSB Digests.

(URL : http://www.mlit.go.jp/jtsb/bunseki-kankoubutu/jtsbdigests_e/jtsbdigests_No3/No3_pdf/jtsbdi-03_0608.pdf)

Outline: While the cargo ship was berthed at the wharf of Port of Saganoseki, Oita City, Oita Prefecture, for discharging a cargo of copper sulfide concentrate at around 08:30, June 13, 2009, one of the workers inhaled oxygen-deficient air and developed hypoxia while descending a ladder inside No. 3 cargo hold on his way to undertaking the job of stevedoring. Two of the three other workers who went to rescue him also developed hypoxia in the cargo hold. All of the three workers were rescued from No. 3 cargo hold, but later they were confirmed dead.

In view of the result of this accident investigation, the Japan Transport Safety Board recommended the smelter (Company A) and the stevedoring company (Company B) to implement the following measures, pursuant to Article 27 (1) of the Act for Establishment of the Board.

Recommendations to Company A

- (1) To train all employees who have the possibility of being engaged in cargo operation to understand the properties and hazardousness of copper sulfide concentrate.
- (2) To train all employees who have the possibility of being engaged in cargo operation with the handling of O₂ meters in order to measure O₂ concentrations safely and surely as necessary.
- (3) To request the MSDS (*1) of floatation reagents from shippers.
- (4) To inform all employees who have the possibility of being engaged in cargo operation that depending on the floatation reagent adhering to copper sulfide concentrate, it may generate toxic gas, and since the generated toxic gas is heavier than air, it stagnates in cargo hold, hence, there is a danger of not being replaced by air.
- (5) To make the risks of oxygen-deficient conditions and hypoxia known to all personnel who have the possibility of being engaged in cargo operation and to familiarize them with appropriate measures to be taken in case of fatal accidents occurring in cargo holds loaded with copper sulfide concentrate.

Recommendations to Company B

- (1) To train all employees who have the possibility of being engaged in cargo operation to understand the properties and hazardousness of copper sulfide concentrate.
- (2) To train all employees who have the possibility of being engaged in cargo operation with the handling of O₂ meters in order to measure O₂ concentrations as necessary.
- (3) To make the risks of oxygen-deficient conditions and hypoxia known to all employees who have the possibility of being engaged in cargo operation and to familiarize them with appropriate measures to be taken in case of fatal accidents occurring in cargo holds loaded with copper sulfide concentrate.

Actions Taken by Company A

- (1) Provided the relevant employees with education on the properties and hazardousness of copper sulfide concentrate.
 - ▶ Main points of the education
 - Copper concentrate, the substance of which is fine powder, has a large surface area, and is likely to generate heat by oxidation when reacting with oxygen in the air inside a cargo hold (copper concentrate consumes oxygen).
 - Oxygen concentration inside a cargo hold of a transport ship is likely to become lower than 18% in most cases while sailing from abroad (oxygen-deficient conditions).
 - In particular, when dew condensation occurs in large amount upon opening hatches of a vessel, careful attention is required because such situation shows that there is heat generation by oxidation to a large extent, and oxygen concentration in the cargo hold may be extremely low.
- (2) The relevant employees of Company A also attended a training course by Company B for handling oxygen concentration meters.
- (3) Provided the relevant employees with training on MSDSs of the floatation reagents which were obtained from the owners of copper concentrate mines. Company B was provided with these MSDSs.
- (4) Provided the relevant employees with education about a danger that some floatation reagents might generate toxic gases, which might stagnate in a cargo hold as they were heavier than air and might prevent substitution with air.
- (5) 1. Disseminated the danger of oxygen-deficient conditions and hypoxia to the relevant employees, in addition to the education as mentioned in (1).

▶ Main points of the education

- Development mechanism of hypoxia and the cause of occurrence
- Symptoms of hypoxia
- Properties and hazardousness of copper concentrate
- Locations likely to cause hypoxia and precautions

2. The relevant employees of Company A also attended a rescue training course by Company B against fatal and injury accidents occurring in a cargo hold loaded with copper sulfide concentrate.

*1: "MSDS" (Material Safety Data Sheet) is a document that contains information necessary for the safe handling of chemical substances or raw materials containing chemical substances

Actions Taken by Company B

(1) Provided the relevant employees with education on the properties and hazardousness of copper sulfide concentrate.

▶ Main points of the education

- Copper concentrate is likely to generate heat by oxidation when reacting with oxygen in the air inside a cargo hold.
- Oxygen concentration is likely to become 18% or lower in most cases while underway from abroad.
- When dew condensation occurs in large amount, oxygen concentration may be extremely low.
- Some floatation reagents contain toxic gases, and they can cause oxygen-deficient conditions.
- MSDSs of floatation reagents

(2) Provided the relevant employees with training for handling oxygen concentration meters.

▶ Main points of the training

- Meter types
- Operation method
- Maintenance method
- Measurement points
- Recording method
- Fitting protectors
- Evacuation in emergency



Oxygen concentration meter

(3) 1. Provided the relevant employees with education on the danger of oxygen-deficient conditions and hypoxia.

▶ Main points of the education

- Development mechanism and the cause of occurrence
- Symptoms of hypoxia
- Properties and hazardousness of copper concentrate
- Locations likely to cause hypoxia and precautions

2. Provided the relevant employees with education and training on how to deal with fatal and injury accidents occurring in a cargo hold loaded with copper sulfide concentrate.

▶ Main points of the education and training

- Judgment criteria for identifying the cause of an accident, whether by oxygen deficiency or not
- Reporting when finding victims
- Prevention of a secondary accident
- Preparations for relief
- Measurement of oxygen concentrations
- Air supply to victims
- Confirmation of the situation and judgment criteria for entering a cargo hold to rescue victims
- Coordination with a rescue team

In view of the result of this accident investigation, the Japan Transport Safety Board expressed its opinions as follows to the Minister of Land, Infrastructure, Transport and Tourism, pursuant to Article 28 of the Act for Establishment of the Board.

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

The Board requests the Minister to widely disseminate through the International Maritime Organization (IMO) such information regarding the risks of the use of floatation reagents as that depending upon the properties of the floatation reagent adhering to copper sulfide concentrate, it may generate toxic gas, and that since the generated toxic gas is heavier than air, it stagnates in cargo hold, hence, there is a danger of not being replaced by air.

Actions Taken by Maritime Bureau, MLIT

At the 17th session of the IMO Sub-Committee on Dangerous Goods, Solid Cargoes and Containers (DSC17) held in September, 2012, the Bureau disseminated the accident information together with the issues identified through the investigation by the Board.

The results of the investigation by the Japan Transport Safety Board are compiled into an investigation report, which then will be publicized. When deemed necessary, the Board also provides recommendations (including safety recommendations) or opinions to relevant ministers or parties involved in the accident, in order for necessary measures or actions to be taken to prevent recurrences and to mitigate the damage caused by accidents.

Safety actions taken in response to the recommendations or opinions provided for a specific accident are publicized on the website of the Board.

http://www.mlit.go.jp/jtsb/kankokuiken_ship.html