Safety Issue Associated With Hotwork on Conveyor Belt Area of Self-Unloading Bulk Carrier

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Abstrak

Welding, cutting, burning, abrasive blasting, and other heat-producing operations are considered as hotwork that potentially creates fire hazard especially on board a ship. Fires in confined spaces such ship compartments, in the loop and tunnel areas are very dangerous, as the conditions are conducive to its rapid spread and also that they are in the vicinity of highly flammable areas. When hot work is being performed in the areas and spaces, required standards and procedures are essential to ensure the safety of all involved in the work. This study try to review some causes of ship fire accident that took place in the past and came out with suggestions for improvement in the area of hotworks in close proximity to a conveyor belt. On methodology, using a case study of an accident on board a ship to know cause that often occur around conveyor belt area of Self-Unloading Carrier (SUL) especially on bulk carrier. The result of study is to reiterate the need for proper monitoring and and supervision of hotwork in close proximity to a conveyor belt as it has contributed adversely to the several fire accident that has taken place in the world shipping trade most especially on the self-unloading(SUL) bulk carriers.

Keywords: self-unloading(SUL) bulk carriers, safety issue, convetor belt area, hot work

1 Introduction

Marine accident means any of the events involving a vessel operating in navigable waters such as the loss of life of, or injury to, any person on board the vessel, the loss of a person from the vessel, the loss of life or injury to a person that is caused by the vessel, the loss, or presumed loss, of the vessel (including the sinking or abandonment of the vessel), the capsizing, grounding or flooding of the vessel, etc (Marine Safety Act 1998). Cause of the accident sequence (fire, explosion, grounding, contact, heavy weather damage, ice damage and etc), fire ranks second in maritime casualties after stranding and grounding according to a survey of total loss accidents in merchant shipping over a period of 25 years. (Kuehmayer, 2008).

Hotwork on boar a ship includes welding, cutting, burning, abrasive blasting, and other heat-producing operations has been the cause of various disastrous such as risk of fire and explosion yet avoidable accidents. Several accident have reported by MAIB (2011) about fire on board ship when hot work taking place on cargo handling area of Self-Unloading (SUL) ship. As generally, most of these caused by lack of standard implementation such as fire detection standard, complacency with respect to hotwork procedure and lack of international standard for the use and control of radioactive isotopes whereas there is radioactive silometers in the area of fire.

The objective of this study try to review safety issue on Self-Unloading (SUL) ships related to causes fire accident and came out with suggestions for improvement in the area of hotworks in close proximity to cargo handling area especially on conveyor belt area.

The methodology is by using a case study of an accident on board a ship to know cause that often occur around cargo handling area of Self-Unloading Carrier (SUL) especially on bulk carrier. Literature review is used as a reference to get recommendation about hotwork procedure, proper monitoring and supervision of hotwork in close proximity to a cargo handling area of SUL bulk carrier.

The case study that used for analysis is accident is Yeoman Bontrup accident in 2010. Previously, the same case also happened in 2006. The accident included hotwork which had not been authorized. The company's investigation found that hotwork debris had become trapped between a roller and the base belt, causing the latter to ignite. The other accident that related to conveyor belt accident in ship are

Vanuatu-registered self-unloader ambassador on 1994, fire occurred on the cross-conveyor belt system and Liberian-registered self-unloader Sophie oldendorff on 2010, the accident also happened on the conveyor belt system. From the accident showed that conveyor belt is a sensitive material can caused fire if exposed to a spark when hotwork place around this area. One of the cause of accident because there are currently no conveyor belt material standards specific to the marine industry (MAIB, 2011)

2 Literature Review

Several researh effort have conducted about marine accident and the prevention. Mullai et al (2011) designed a conceptual model for analysis of marine accidents, included one of which was about fire and explosion in machinery, cargo, and other spaces and electrical installations. The model in this study was grounded on large amounts of empirical data and these were analyzed using the structural equation modeling (SEM) approach.

Study of fire and explosion conducted by Shaluf et al (2003). The study analyzed major hazard installations in a ship and a industry company about the link between the major hazard organizations is an interface between the installations and also discusses the causes which led to this major accident. It was found that the lack of integrity is the main cause behind the escalation of the fire and explosion. Almost the same as Shaluf et al (2003), Schröder-Hinrichs et al (2010) also did a research about accident investigation in fires and explosions related to organizational factors and the accident. Study reviewed of 41 accident investigation reports related to machinery space fires and explosions by using method of Human Factor Analysis and Classification System (HFACS). The results of the review show that organizational factors were not identified by maritime accident investigators to the extent expected had the IMO guidelines been observed. Instead, contributing factors at the lower end of organizational echelons are over-represented.

Fire in ship became important issue over the years, even fire occupy the second rank in maritime casualties and one of the fire cause is hot work (Kuehmayer, 2008). Bradley (2002) reported fire and explosion incidents; 13% of injuries and 9% of incidents involving flammable liquid were caused by hotwork in Great Britain on 1998–2000.

Other paper conducted by ILO (1996). The paper have made a practical recommendation about Accident Prevention On Board Ship At Sea and Port for use by all those who have responsibility for safety and health on board ship. Its also provide guidance to ship owners and seafarers and others concerned with the framing of provisions of this kind in both the public and private sectors. Some important part on this paper that related to study are fire prevention especially on prohibition to smoke, firefighting equipment, and hot work on ship such as welding and flame-cutting.

Hotwork can cause of various disastrous such as risk of fire and explosion if near to flammable material. API (2009) made a practice reference of precautions necessary during such hotwork operations, consideration of the conditions and equipment in areas next to the work area is needful when planning activities. The fact that conditions can change and new hazards can be created during the operation also needs to be taken into account. For example, hydrocarbons can vapourize from the heat produced during hot work.

3 Methodology

Methodology in this paper based on case study of ship accident which reported by Marine Accident Investigation Branch, UK (2010) about the fire and explosion on board on Yeoman Bontrup. In general, this accident occur caused by hotwork activities during cargo loading in conveyor belt area. A more complete explanation in following chapter.

Several issue which raised in this paper is safety issue related to the hotwork in conveyor belt area of SUL ship. The issue of safety in this paper are related to the fire detection, containment and extinguishing in conveyor belt area, standard for conveyor belt system, standard for use and control radioactive istope, and complacency procedure to hotwork procedure in conceyor belt area of self-unloading bulk carrier.

To propose the result, using several literature review to get recommendation about hotwork procedure, proper monitoring and supervision of hotwork in close proximity to a cargo handling area of SUL bulk carrier.

4 Yeoman Bontrup Fire Accident

Vessel Overview

Yeoman Bontrup were the world's largest gravity fed self-unloading (SUL) bulk carriers. The ships were fitted with five cargo holds totalling 89896.8 m3. A complex system of conveyor belts discharged cargo into a hopper, situated in a tower immediately forward of the accommodation block and bridge. The cargo then passed onto a boom conveyor for shore reception.

The Ship were built partly from high tensile steel, which had suffered extensive cracking, requiring long-term management with the agreement of Lloyd's Register, the ships' classification society. At the time of the accident the owner's Technical Superintendent Structural Repairs (TSSR) was on board to carry out structural surveys and oversee structural repairs.

The ship was manned by 31 Ukrainian crew, most of whom had served with the company for many years.

The manning level was well in excess of the 14 crew required by the Safe Manning Certificate. The official working language was English, but the day-to-day language spoken was Russian. The documentation was in English

TABLE I

SHIP INFORMATION

Registered owner	Western Bridge (Shipping) Limited
Vessel operator	Aggregate Industries UK Ltd
Manager	V.Ships UK Ltd
Flag & port of registry	Bahamas, Nassau
Type	Bulk carrier – self-unloading (SUL)
Date built and builder	1991, Tsuneishi Shipbuilding Co Japan
IMO number	8912297
Classification society	Lloyd's Register
Length overall, breadth	249.9m, 38m
Gross tonnage	55695

Area of Accident

A major fire and explosion occurred on board the Bahamian- registered, self-unloading (SUL) bulk carrier Yeoman Bontrup during cargo loading. The need for repairs to Yeoman Bontrup's cargo discharge hopper, which required hotwork on arrival at the remote Glensanda Quarry on Loch Linnhe. Location of incident was alongside the shiploader jetty at Glensanda Quarry on Loch Linnhe, Western Scotland at 15:19 on 2 July 2010.

Accident Overview

The accident present category of a very serious marine casualty. The accident created significant fire damage and severe distortion to several area of the ships such as the self-unloading system, engine room, accommodation areas and steering gear compartment and detachment of the poop deck.

On 2 July 2010, a major fire and explosion occurred on board the Bahamian- registered, self-unloading (SUL) bulk carrier Yeoman Bontrup during cargo loading. The fire spread rapidly, resulting in significant damage to the vessel. Fortunately, injuries were minor. A routine post-discharge survey identified the need for repairs to Yeoman Bontrup's cargo discharge hopper, which required hotwork on arrival at the remote Glensanda Quarry on Loch Linnhe.

At 1519 on the day, a fire was discovered near the bottom of the vertical cargo conveyor belt. Although attempts were made to extinguish the fire, it spread to the adjacent engine room. Overwhelmed by the scale of the fire, the crew evacuated the ship. The fire spread rapidly to the accommodation and into the steering gear compartment, which contained a wide variety of ship's-use chemicals. A violent explosion followed which tore the poop deck from the ship.

The most likely cause of the fire was the ignition of the vertical conveyor belt by hot debris from the hopper repair work. Although the vessel was built to the required standards, the fire spread quickly. This was because there was no effective means of early detection, no means of dividing the large cargo handling area for containment purposes, and no fixed fire-fighting system in the cargo handling area to deal with the fire (MAIB, 2010).

Investigation of the accident done by Marine Accident Investigation Branch, UK (2010) discover several problem great cause of the accident such us high frequency of hotwork repair on board Yeoman Bontrup had led to violations of company procedures which compromised safety, discovered radioactive silometers in the area of the fire. These had not been included in the list of hazardous materials on board, had not been identified during risk assessments, and were not subject to any control procedures and the highly flammable of conveyor belt elements.

5 Legal Basis and General Procedure

General Hotwork on Conveyor Belt

Designated hotwork areas and procedures for hotwork of ship actually has had certain procedure regulation. For instance, designated hotwork areas and procedure of hotwork activities on Yeoman Bontrup complied to the V.Ships Management System (VMS). VMS designated for hotwork area showed that the engine room workshop was the only designated space that hotwork involving welding, burning, naked flame, high temperature, arc or a continuous spark process could be carried out without requiring prior approval from the ship's manager.

V.Ships Management System (VMS) for hotwork activities also mention about hotwork procedure. There are two category for the procedure, those tha required prior approval from the superintendent, and those that did not. The completed risk assessment and hotwork request engaged MS&Q superintendent technical superintendent to determine whether or not the hotwork was to be allowed appropriate to V.Ships Management System (VMS).

Fire Detection, Containment And Extingushing For Conveyor Belt System

It is difficult to detect and suppress a small fire on a moving belt, but effective systems do exist. They do not always prevent belt damage, but will prevent structural collapse. Detection takes the form of heat sensing.

Generally, fire protection, detection and extinction has regulated by SOLAS Chapter II. There are several regulation part on SOLAS Chapter II which can used as a reference. SOLAS Chapter II, regulation 7 briefly explained that shall be provided fixed fire detection, fire alarm system and smoke detection system and also comply with the Fire Safety Systems Code. The entire requirement also required in conveyor belt area as hazardous area. SOLAS Chapter II in regulation 9 and regulation 10 each explain about containment of fire and fire fighting for all area of ship.

Self-Unloading System (SUS) on Bulk Carrier

The International Convention for the Safety of Life at Sea 1974 (SOLAS), does not contain regulations covering the SUS equipment or conveyor belt requirements, and the system is not covered by classification society rules. Moreover, MAIB (2010) report mentioned that there are currently no conveyor belt material standards specific to the marine industry.

In Yeoman Bontrup, there is using V.Ships Management System (VMS) to regulate the high risk of fires developing in the areas of the conveyor belts included hotwork in conveyor belt area. More detail of this explanation described in Self-Unloader Vessel Operating Instructions which is a supplement of the VMS.

Standard For Use And Control Radioactive Isotope

Cargo in the hopper of Yeoman Bontrup was originally monitored by two radioactive silometers. The silometers were designed to identify cargo blockages in the hopper and stop the SUS in a controlled manner to prevent damage. he silometers comprised a radiation source, a detector and an electronic process controller. The system had not been in operation for the past 10 years, the silometers had remained on board (MAIB, 2010). In this Accident, radioactive sources were not recorded on the VMS Technical Form- TEC 22 - Inventory of Potentially Hazardous Materials in the Ship's Structure and Equipment. The VMS itself did not include any safety or general information relating to the radioactive source containers.

In addition, there is regulation which is regulate to controlling the transport of radioactive cargoes. The regulation is The UK's Statutory Instrument 1999 No.3232, Health and Safety, The Ionising Radiation Regulations 1999 provides detailed requirements regarding the management of radioactive sources.

Complacency To Hotwork Procedure

Poor hotwork discipline and a failure to follow established guidelines is a significant cause of fires in ships, many of which could have been avoided by proper oversight. In V.Ships Management System (VMS) contained comprehensive instructions and procedures on how hotwork procedure.

Ship's-use chemicals

There is a lot of guidance and regulation regarding the carriage of dangerous goods as cargo. Despite similar risks, there is virtually no formal guidance concerning the stowage of ship's-use chemicals, except for passing reference in COSWP of the need to refer to the specific MSDSs for advice on separation and segregation.

Housekeeping Problem

Good housekeeping is an important aspect of effective on board management of risks and ensuring the crew's wellbeing and safety. Measures should be taken to ensure that all such chemicals and oils are kept in a safe, approved stowage. While not always obvious, housekeeping malpractices have potential as causes of fire spread.

6 Result and Discussion

Safety issues raised in this paper are the things related to hotwork in close proximity to cargo handling area especially on conveyor belt area. First, complacency with respect to hotwork procedures. The crew should follow the procedures in the implementation of hotwork even there is high frequency of hotwork repairs. Second, although there were no classification society rules or SOLAS regulations governing the cargo-handling areas and equipment on self-unloading bulk carriers, the ship should be able to complied with the extant standards in attempts to contain and fight the fire were hampered by several factor such as high fire risk if conveyor belts caused by flammable material when hotwork conducted in close proximity of the area, requirement for detectors of smoke and fire around the conveyor belt area, requirement for fire containment method to prevent fire spread quickly through the compartment and other area where is close to fire source and requirement for fixed fire-fighting system for compartment around conveyor belt and cargo handling area and it is necessary to include into Safety Action Plan of the ship. Third, consider on the stowage of ship's-use chemicals even there are no standard, instructions or formal guidance. This thing is to prevent spread of fire if the source closes to chemicals stowage. Fourth, poor housekeeping resulted in chemicals and oils being stowed in place that should not, can increased the risk of the spread of fire. Fifth, requirement of radioactive source on ships should be input on “Inventory of Potentially Hazardous Materials in the Ship’s Structure and Equipment” or follow extant standards about the subject.

Recommendation for SUL owner and operator is requirement for establish a forum with other major self-unloading shipping companies to discuss mutual SUL safety issues, including the need for fire protection, detection and extinguishing systems in the cargo handling spaces.

6 Conclusion

This paper proposes several requirements for hotwork. Previous chapter explain overall requirement to reiterate the need for proper monitoring and and supervision of hotwork in close proximity to a conveyor belt as it has contributed adversely to the several fire accident that has taken place in the world shipping trade most especially on the self-unloading (SUL) bulk carriers. The requirement is need to ensure all things put into consideration both condition of area and management before start hotwork activities.

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