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INCIDENT CASE STUDY No.1

BRITANNIA COMMENTARY | NOVEMBER 2020

OVERVIEW AS PART OF THE CASE STUDY MATERIAL, THE FOLLOWING COMMENTARY HAS BEEN PREPARED TO FURTHER CONSIDER SOME OF THE KEY ISSUES IN ORDER TO SUPPORT REFLECTIVE LEARNING.

The first three pages of this commentary discuss some of the contributory factors and lessons learned in more detail with particular reference to best practices. The final page graphically illustrates some of the barrier control measures that could have potentially mitigated against the risks associated with the hazards by making use of Britannia's interpretation of the Hierarchy of Barrier Controls triangle as a framework.

DEATH OF THIRD ENGINEER DUE TO BURN INJURIES

THIS FATALITY APPEARS TO BE A RESULT OF A CHAIN OF CONTRIBUTORY FACTORS, THE COMBINATION OF WHICH LED TO THE ACCIDENT. IF THE HAZARDS HAD BEEN CORRECTLY IDENTIFIED AND THE APPROPRIATE RISK CONTROLS HAD BEEN IN PLACE, THE TRAGIC DEATH OF THE THIRD ENGINEER (3/E) COULD HAVE BEEN PREVENTED.

It is worth mentioning that a lack of experience was not a factor: all of the Engineers involved were experienced marine professionals. This did not prevent them from making assumptions with regard to the safety of the work environment.

The case study and investigation identified a number of factors and lessons learned, as discussed below.

JOB HAZARD ANALYSIS AND HAZARD IDENTIFICATION

The Chief Engineer (C/E) had conducted and recorded a "Job Hazard Analysis" (JHA) for the inspection and maintenance of No.2 "Waste Oil Settling" (WOS) Tank the day before the accident. However, the investigation found that the JHA did not identify all of the potential hazards, including those relating to the quantity remaining in the tank and to the malfunctioning level gauge. Instead, the JHA relied on the professional knowledge and expertise of the involved personnel.

The hazard identification and risk assessment completed prior to the task should capture all hazards relevant to the job. If a generic risk assessment is insufficient to achieve this, a specific task-based risk assessment should be completed in line with the provisions of the Safety Management System.

The opening of the tank required the engine personnel to determine that the tank was empty before removing the manhole cover; however, as the level gauge was not working, this therefore had to be confirmed by other means.

Although it was expected that the two engineers would have applied their professional knowledge and expertise to verify that the tank was empty, a correct hazard identification should have:

- increased the awareness and prevented the two engineers from skipping critical steps of the procedure for safely opening the manhole cover.
- assisted in avoiding this tragic accident by increasing the focus and preventing a false perception that the tank had been drained. This ultimately resulted in steps in the established procedure for the safe opening of the manhole cover being skipped.

TOOLBOX TALK

Opening the tank was the second job planned for the Engine crew on the day. The investigation did not determine whether progressing directly from one task to another may have contributed to the absence of a toolbox talk or a similar meeting prior to the accident.

A toolbox talk is a short meeting with the involved personnel immediately prior to commencing work. It provides an invaluable opportunity to talk through the instructions of the job at hand and the findings of the risk assessment and ensure that everyone is on the "same page". An effective toolbox talk prior to opening the manhole cover should have considered the findings of the JHA, and would have further helped to identify the hazards and necessary precautions to prevent the accident from occurring.

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STOP WORK

A supervisor should apply his critical judgement to the safety of the work environment and the activities of the personnel they are supervising, and use their authority to stop work at any time if they observe a condition or activity they perceive as unsafe. This can be supported by a Stop Work Authority (SWA) program providing crew members with the responsibility and obligation to stop work in case of an apparent unsafe condition or behaviour. A successful SWA program should enable the crew to use this authority without retribution.

NO ALTERNATIVE MEANS OF MEASUREMENT

The Waste Oil Settling (WOS) tank was not fitted with a sounding pipe as an alternative means when the level gauge malfunctioned. Although not a requirement under the Safety of Life at Sea (SOLAS) Convention and Class Society requirements, had a sounding pipe been fitted, this would have allowed the two engineers to verify the contents of the tank.

NO SPECIFIC INSTRUCTIONS FOR THE PERIODIC CLEANING OF THE WASTE OIL SETTLING TANKS

The vessel's Planned Maintenance System (PMS) did not provide guidelines for periodic routine maintenance/cleaning of the WOS tanks in order to remove the heavy oil residues and avoid the jamming of the level gauges caused by the oil sludge mud accumulating at the bottom of the tanks. The cleaning requirements were therefore decided by the crew based on how each tank was operated. Had an appropriate and regular regime for cleaning the tank been in place, this would have helped avoid the need for this unplanned and hazardous task. The investigation report recommended that the PMS should be amended accordingly.

It is noted that the International Association of Class Societies (IACS) "Guide to Managing Maintenance in Accordance with the Requirements of the ISM Code" is a useful reference in this regard:

CONFIRMATION BIAS

The investigation suggested that confirmation bias, where a person tends to favour information that confirms their already existing beliefs, may have led to the two engineers' perception that the WOS Tank had emptied. However, this was based on flawed assumptions: the level gauge mechanism had been identified as malfunctioning; while the drain valves of the oil tanks were known to be susceptible to clogging by the oil sludge mud.

SAFE PRACTICES FOR THE OPENING OF THE MANHOLE

The investigation found that the 3/E's false perception that the tank had been fully drained contributed to him skipping the necessary steps. The 2/E who was supervising the operation, had also falsely perceived that the tank was empty and allowed the 3/E to proceed with opening the manhole without applying the common practice.

In short, the common practice identified in the investigation report to safely remove this type of manhole cover is to:

- remove all nuts except four crosswise;
- slightly loosen the four nuts by no more than ½ turn;
- tighten the jackscrews to detach the cover from the seat;
- If a leakage is observed, the cover may be easily secured back by loosening the jackscrews and re- tightening the nuts.
- If no leakage is observed, loosen the nuts another ½ turn and tighten the jackscrews.
- If there is still no leakage, continue to loosen the four crosswise nuts and remove the cover.

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SAFE PRACTICES FOR THE OPENING OF THE MANHOLE (continued)

Had this procedure been correctly applied, then the likelihood and consequences of the accident should have been greatly reduced.

Taking shortcuts from a safe work procedure to save time and effort can lead to undesirable and even tragic consequences. Had the two engineers taken additional means to confirm the tank had been drained, for example, by measuring the quantity of the BSO Tank to ascertain if it had increased as expected, this would have helped identify that it was not safe to open the manhole cover without, at the very least following an appropriate procedure with the careful use of the jackscrews.

However, the quantity of the BSO Tank was not verified, possibly as it required going to the lower level of the engine room to sound the tank.

Had a procedure been followed to confirm the draining of the tank, this could have alerted the two engineers to key factors that contributed to the accident including: the absence of a sounding pipe; the susceptibility of the drain pipes to clogging, and therefore the need to confirm that No.2 WOS Tank had been drained by measuring the BSO Tank.

TEMPERATURE OF THE SLUDGE OIL REMAINING IN THE TANK

Although the heating valves of the No.2 WOS Tank had been closed, the adjacent No.1 WOS Tank was continually heated. As a result, the contents remaining in the No.2 WOS Tank were indirectly heated to about 86˚C through conduction. It was this temperature of the sludge that caused the 2nd degree burns to the 3/E's body, which tragically led to his death due to septic shock while in hospital.

PROTECTIVE CLOTHING

The 3/E was wearing common type coveralls made of cotton fibre, which did not protect his body from the hot sludge. The investigation reported that the use of a heat/flame protective clothing complying with ISO 11612 could have provided better protection to the 3/E's body than the cotton overall that he was wearing. It therefore recommended that the company consider providing the crew with heat/flame protective clothing for use during operations with burn injury hazards.

See next page for Hierarchy of Barrier Controls graphic.

THIS CASE STUDY IS DRAWN FROM THE INVESTIGATION REPORT 14/2013 PUBLISHED BY THE HELLENIC BUREAU FOR MARINE CASUALTIES INVESTIGATION – HBMCI AT:
http://www.hbmci.gov.gr/js/investigation%20report/final/14-2013%20CAPTAIN%20PETROS%20H.pdf

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HIERARCHY OF BARRIER CONTROLS

MOST EFFECTIVE

HIERARCHY OF BARRIER CONTROLS	CONTROL TYPE	EXAMPLES OF POSSIBLE RISK MITIGATION CONTROL MEASURES RELATED TO THE CASE STUDY
ELIMINATE THE HAZARD		**INVESTIGATE** the correct temperature to avoid excessive heating of he sludge? **IMPLEMENT** a PMS requirement for periodic cleaning of the WOS tanks to avoid the jamming of level gauges.
SUBSTITUTE THE HAZARD		**PROVISION** of a sounding pipe to provide a safer means of verifying the tank contents?
ISOLATE THE HAZARD	PHYSICAL CONTROLS/BARRIERS	**POSSIBLE** provision of insulation between the two tanks to reduce the heating of the sludge through conduction?
INFLUENCE BEHAVIOURS	ADMINISTRATIVE CONTROLS/BARRIERS	SMS/structured pre-work assessment of system safety • **EFFECTIVE MANHOLE OPENING PROCEDURES.** • **JOB HAZARD ANALYSIS (JHA)** • **TOOLBOX TALK**
	BEHAVIOURAL/SKILL CONTROLS/BARRIERS	Means of avoiding confirmation bias, complacency? Implementation of a Stop Work system?
PROTECT	PPE CONTROLS	**INVESTIGATE** the correct temperature to avoid excessive heating of he sludge? **IMPLEMENT** a PMS requirement for periodic cleaning of the WOS tanks to avoid the jamming of level gauges.

LEAST EFFECTIVE

The suggested barriers/controls above are provided to help generate reflective discussions, and should not be considered as conclusive/definitive or comprehensive for the provided case study.
The risk and control measures relating to any similar scenario or activity must always be appropriately assessed based on the specific onboard arrangement and circumstances.