BSAFE

INCIDENT CASE STUDY No.8

BRITANNIA COMMENTARY | JUNE 2021

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.

CHEMICAL BURNS INCIDENT

THE CAUSE OF THIS INCIDENT APPEARS TO BE THE COMBINED FAILURE OF SEVERAL INTENDED SAFETY BARRIERS, RESULTING IN THE CHEMICAL BURN INJURIES SUSTAINED BY THE 3/O. THE ASSOCIATED HAZARDS COULD HAVE BEEN CORRECTLY IDENTIFIED AND APPROPRIATE RISK CONTROLS APPLIED IF A PROPERLY IMPLEMENTED SAFETY CULTURE HAD EXISTED ON BOARD.

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

TANK CLEANING PLAN AND RISK ASSESSMENT

The cleaning of cargo tanks is a routine but important operation on board a chemical tanker and should be conducted in accordance with the requirements of MARPOL Annex II and the IBC code[1], while also taking into consideration the specific characteristics of the cargoes involved and the ship. It is also an activity where the crew may be exposed to various risks, including handling of the chemicals and the general hazards associated with entering an enclosed space. This cleaning operation would normally be expected to have been covered under the onboard Safety Management System (SMS) on a modern chemical tanker, with a crew fully familiar with and acting in accordance with its provisions. Although a copy of the company's fleetwide guidelines for tank cleaning and preparing a tank cleaning plan was obtained as part of the investigation, ship-specific guidelines were not made available. Following the incident, a tank cleaning plan based on a thorough risk assessment was not found and the investigation concluded that these documents had not been prepared. The completion of these documents prior to the task being undertaken would have captured and recorded the hazards associated with the removal of the caustic soda using a mobile pump, as well as the necessary precautions to be taken. A detailed plan would have also assisted the crew to successfully complete the tank cleaning activities in an efficient and timely manner. Various sources of industry guidance are also available to assist with the preparation of effective cargo-specific tank cleaning plans, including guidelines provided by chemical majors or by independent organisations (e.g. Dr Verwey's or Miracle), which can supplement a company's own SMS procedures.

Following the incident, it was reported that the tank cleaning operation procedure, and checklists relating to work permits, were revised by the operator of the tanker and circulated to their fleet.

SAFETY CULTURE

The investigation concluded that the onboard implementation of safety management did not meet international standards. At the time of the incident, the vessel had been operational for four months and had only been issued with an interim Ship Management Certificate as allowed by the ISM code. This may, to a certain extent, explain why the SMS appeared not to be fully implemented at the time of the incident. It is important that a comprehensive safety culture is established from the first day that a ship becomes operational, as hazards will be present from the outset and not wait for a procedure to be developed or implemented.

The safety culture defines the ways in which safety is managed on board a vessel and is reflected in the shared attitudes, beliefs, perceptions and values of the crew in relation to safety. An effective safety culture results in an organisation where the shared beliefs and behaviours from the top to the bottom result in all employees feeling responsible for improving safety and performance. Owners, managers and masters play a key role in embedding and driving a strong onboard safety culture. In this instance, this should have led to the the unsafe practices onboard being identified and eliminated.

[1]The International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code), as adopted in 1983 and renewed in 2004, amended in 2018 and 2019, and the Index of Dangerous Chemicals carried in Bulk.

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PPE

The injured 3/O was wearing PPE which included cotton overalls, a rubberised jacket, safety boots, protective gloves, goggles and a safety helmet. However, the cotton overalls were not suitable for the task while the safety googles were open at the sides exposing his eyes. According to the investigation, neither the safety googles nor the overalls complied with European safety regulations, while also failing to meet the requirements of the IBC code, which requires tight-fitting eye goggles or a face shield, or both, and the general advice provided on the material safety data sheet (MSDS) for caustic soda. Furthermore, the IBC Code requires that protective clothing and equipment should cover all skin so that no part of the body is unprotected.

As indicated in the Hierarchy of Barrier Controls diagram on the final page, the use of PPE should generally be regarded as the last resort to protect a crew member against hazards while conducting a task. However, it is imperative that the PPE required is identified prior to the work commencing and that it is inspected to ensure it is suitable, in a good condition and correctly worn by the crew members undertaking the task. This is of particular importance when working with hazardous chemicals, such as caustic soda, which is corrosive and can cause severe chemical burns.

TRAINING

The investigation concluded that the crew demonstrated an apparent lack of training and capability both in terms of preparing the tanks for the cargo and safely handling the cargo. This was evidenced by the crew's inability over a period of eight days to clean the cargo tanks to a suitable standard to allow the loading of the caustic soda, despite guidance being provided by the tank inspector in attendance. Furthermore, an unusually high level of palm oil residue (untreated palm oil had been part of the previous cargo) was observed on the main deck following the incident. A mobile pump had been installed to remove the residues, which were indicative of the crew's apparent difficulties in dealing with the previous cargoes. The PSC inspection carried out the day after the incident concluded that *'Due to the current situation it seems that the crew was not very familiar with handling the cargo (palm oil) or has not enough experience with chemical tanker operations. Internal audit is required'.*

Proper training is essential for the safe operation of a chemical tanker, particularly in terms of cargo handling procedures and the use of protective equipment, as required by Chapter 16 of the IBC Code. Training not only provides the crew with the correct skillset in order to safely operate a ship without incident, it also familiarises them with the risks associated with the various shipboard operations and thereby increases safety awareness. In this case, this level of enhanced awareness would not only have ensured that appropriate PPE was put on before entering the tank, but also ensured the provision of additional safety precautions, such as having first aid equipment near to the tank entrance. The IBC code requires that suitably marked decontamination showers and an eyewash station shall be available on deck in convenient locations onboard chemical tankers. The availability and use of such a station on deck during this incident would have saved valuable time in terms of being able to rinse the 3/O's eyes immediately instead of taking him to his cabin to start the first aid. Given that the severity of the injuries associated with caustic soda burns is proportionate to any delay in rinsing the affected eyes or skin, the provision and use of such equipment is essential.

Following the incident, the operator of the tanker carried out onboard training covering the following topics: tank washing, dangerous slippery surface effects, use of PPE, preparation of port discharging and loading operations, preparation of PSC and planned maintenance, human factors, team building, team working, time efficiency and risk assessment. Furthermore, it was reported that this incident scenario was subsequently included in the company's incident training programme.

STOP WORK AUTHORITY (SWA)

Had the master or bosun intervened and stopped the 3/O and O/S from entering the cargo tank while wearing inappropriate PPE, then the incident could have been prevented. Given their leadership roles, the master and the bosun, as well as other onboard officers, should always be able to apply their critical judgement to the safety of the work environment and the activities of the personnel they are supervising. This should include using their authority to stop work at any time if they observe a condition or activity that is perceived to be unsafe. This can be supported by a Stop Work Authority (SWA) programme providing all crew members with the responsibility and obligation to stop work due to an apparent unsafe condition or behaviour. A successful SWA programme should enable the crew to use this authority without retribution and therefore contribute to an effective onboard safety culture.

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COMPLACENCY

Although the investigation was unable to determine due to the lack of evidence, whether the 3/O intentionally ignored the guidelines for the use of correct PPE, it was assumed that this was the PPE typically on board worn for such work. If so, this may again be indicative of an ineffective safety culture resulting in complacent behaviour.

Complacency may have become a factor due to the repeated tank cleaning operations in the days leading up to the incident. Even though the tank cleaning operations were unsuccessful, it is possible that the crew had grown increasingly comfortable with the equipment and PPE being used during the repeated operations and came to believe that they were of an adequate standard. However, it is also possible that the requirement to complete a tank cleaning plan and risk assessment were ignored given the increasing urgency to demonstrate that the tanks were in an appropriate condition to load the cargo.

Complacency may lead to a person taking shortcuts from an established safe work procedure to save time and effort. However, this can also lead to undesirable consequences. Similarly, any assumptions made about the safety of the work environment and the required control measures can also lead to unexpected hazard exposure and injury. Complacency can be avoided by always taking a minute to think about the job at hand to consider what can go wrong and how, and what steps you can take to minimise the risks.

CONDITION OF EQUIPMENT

The investigation was unable to establish whether the worm drive hose clamp securing the hose to the pump parted due to fatigue or another underlaying cause, as the clamp was reportedly not found following the incident. The investigation also did not determine whether either the pump or the other hose clamp fitted on the suction hose, which was assumed to be similar to the one that parted, were considered fit for purpose and of an appropriate design.

It is important that a thorough inspection is made of any equipment before it is used to ensure that it is in a good working condition and fit for purpose. Special attention should be given to any pressurised parts to ensure that all fittings and couplings, for example, are correctly tightened and not showing any signs of significant wear or damage that may reduce their strength. It is also essential to ensure that securing devices, such as hose clamps, are of an appropriate construction and torque for the maximum pressure of the pump and system, especially when the liquid being pumped is hazardous. Furthermore, any safety equipment identified as being unsuitable should be promptly removed and marked accordingly to prevent its use until it can be safely disposed of.

SEE NEXT PAGE FOR HIERARCHY OF BARRIER CONTROLS DIAGRAM

THIS CASE STUDY IS DRAWN FROM THE INVESTIGATION REPORT 301/09 PUBLISHED BY THE FEDERAL BUREAU OF MARITIME CASUALTY INVESTIGATION (BSU) AT:
https://www.bsu-bund.de/SharedDocs/pdf/EN/Investigation_Report/2012/Investigation_Report_301_9.html

THE PURPOSE OF THIS CASE STUDY IS TO SUPPORT AND ENCOURAGE REFLECTIVE LEARNING. THE DETAILS OF THE CASE STUDY MAY BE BASED ON, BUT NOT NECESSARILY IDENTICAL TO, FACTS RELATING TO AN ACTUAL INCIDENT. ANY LESSONS LEARNED OR COMMENTS ARE NOT INTENDED TO APPORTION BLAME ON THE INDIVIDUALS OR COMPANY INVOLVED. ANY SUGGESTED PRACTICES MAY NOT NECESSARILY BE THE ONLY WAY OF ADDRESSING THE LESSONS LEARNED, AND SHOULD ALWAYS BE SUBJECT TO THE REQUIREMENTS OF ANY APPLICABLE INTERNATIONAL OR NATIONAL REGULATIONS, AS WELL AS A COMPANY'S OWN PROCEDURES AND POLICIES.

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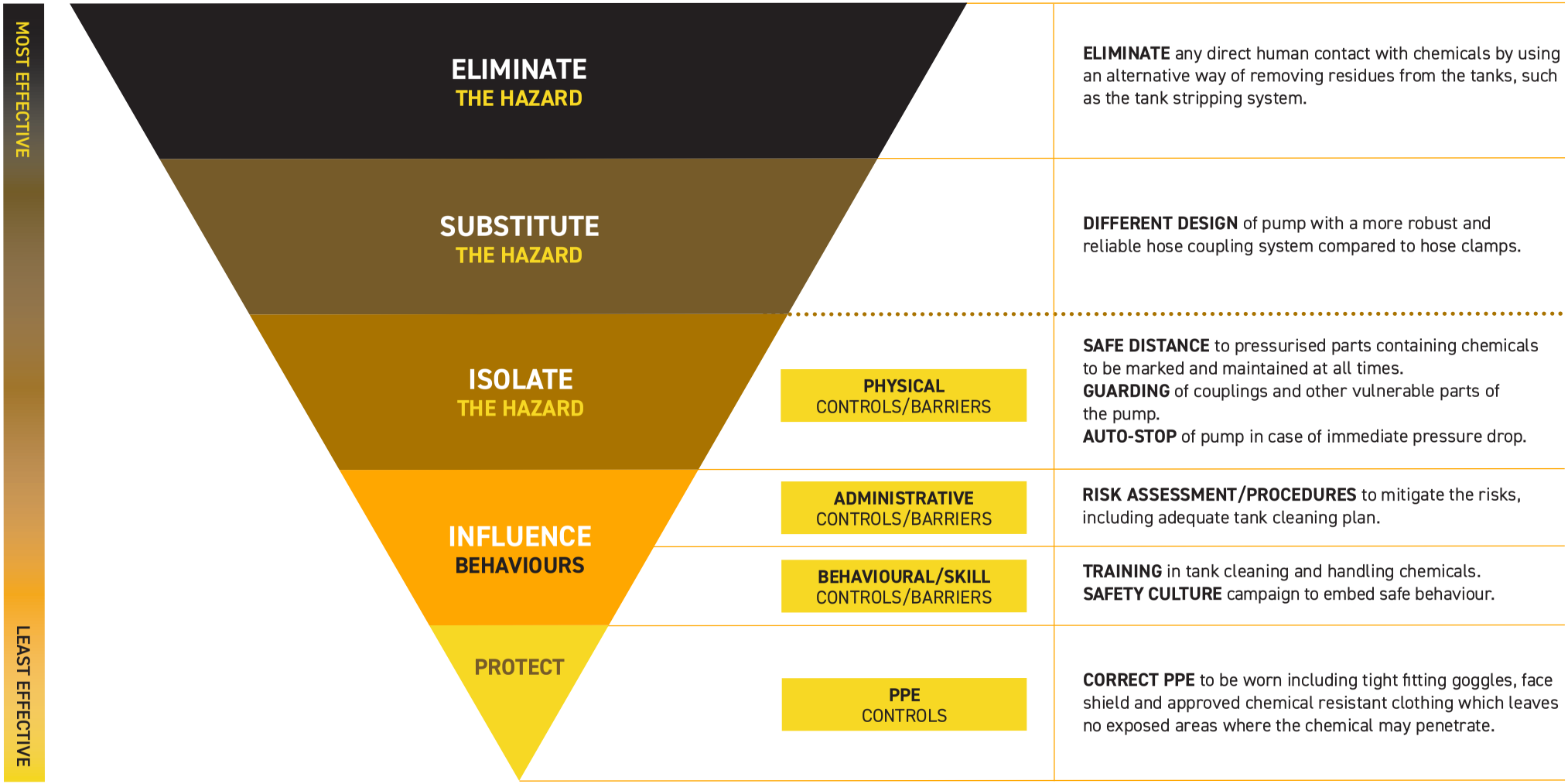
HIERARCHY OF BARRIER CONTROLS



EXAMPLES OF POSSIBLE RISK MITIGATION CONTROL MEASURES RELATED TO THE CASE STUDY

ELIMINATE any direct human contact with chemicals by using an alternative way of removing residues from the tanks, such as the tank stripping system.

DIFFERENT DESIGN of pump with a more robust and reliable hose coupling system compared to hose clamps.

SAFE DISTANCE to pressurised parts containing chemicals to be marked and maintained at all times.
GUARDING of couplings and other vulnerable parts of the pump.
AUTO-STOP of pump in case of immediate pressure drop.

RISK ASSESSMENT/PROCEDURES to mitigate the risks, including adequate tank cleaning plan.

TRAINING in tank cleaning and handling chemicals.
SAFETY CULTURE campaign to embed safe behaviour.

CORRECT PPE to be worn including tight fitting goggles, face shield and approved chemical resistant clothing which leaves no exposed areas where the chemical may penetrate.

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.