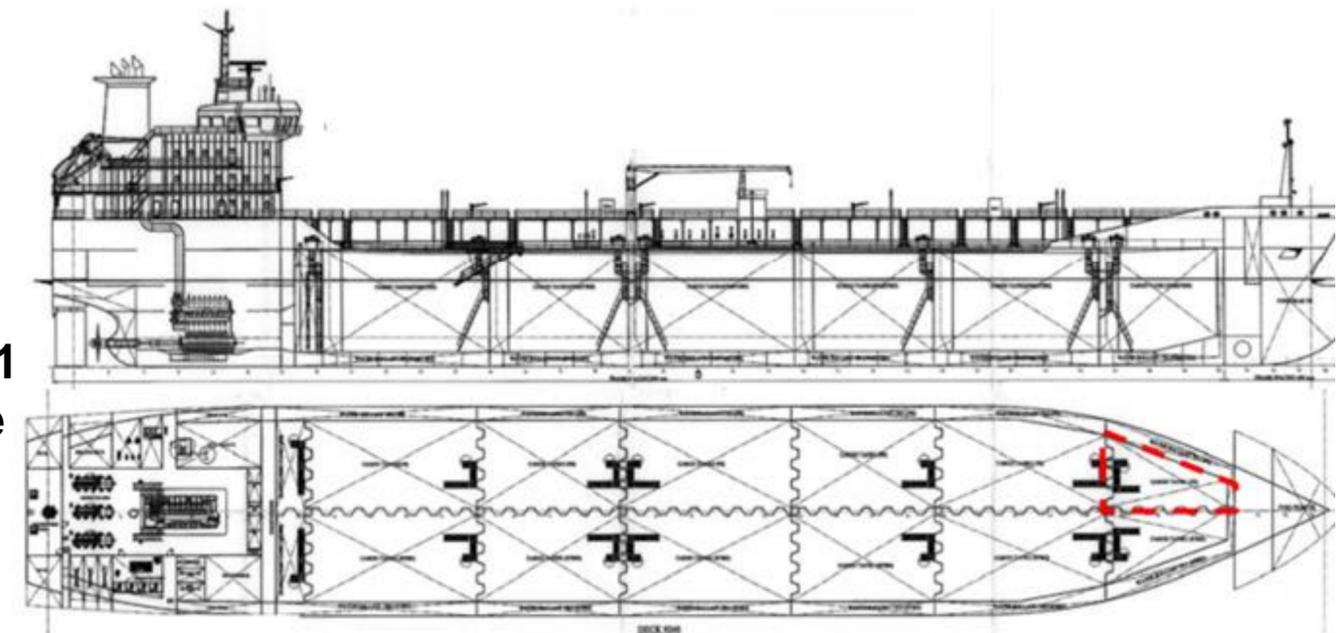


Chemical Burns



BACKGROUND

- A 12,162 GT chemical tanker was anchored at a roadstead in the lower reaches of a river and was in ballast condition.
- The crew were preparing its tanks for loading a cargo of 50% sodium hydroxide solution (caustic soda) in ten of the ship's twelve cargo tanks.
- The tanker had previously carried RBD (refined, bleached, deodorised) palm stearin in six of the tanks, including tank no.1 port, along with crude palm oil, coconut oil and biodiesel in the other tanks.
- The tanker had only been operating for four-months and the same crew had been on board throughout this period.
- In the days preceding the incident, the crew made various attempts to prepare the ship's tanks for the new cargo. However they were each time rejected by the attending tank inspector.



General arrangement plan showing the location of tank no.1 port in red.

Source: Federal Bureau of Maritime Casualty Investigation (BSU)

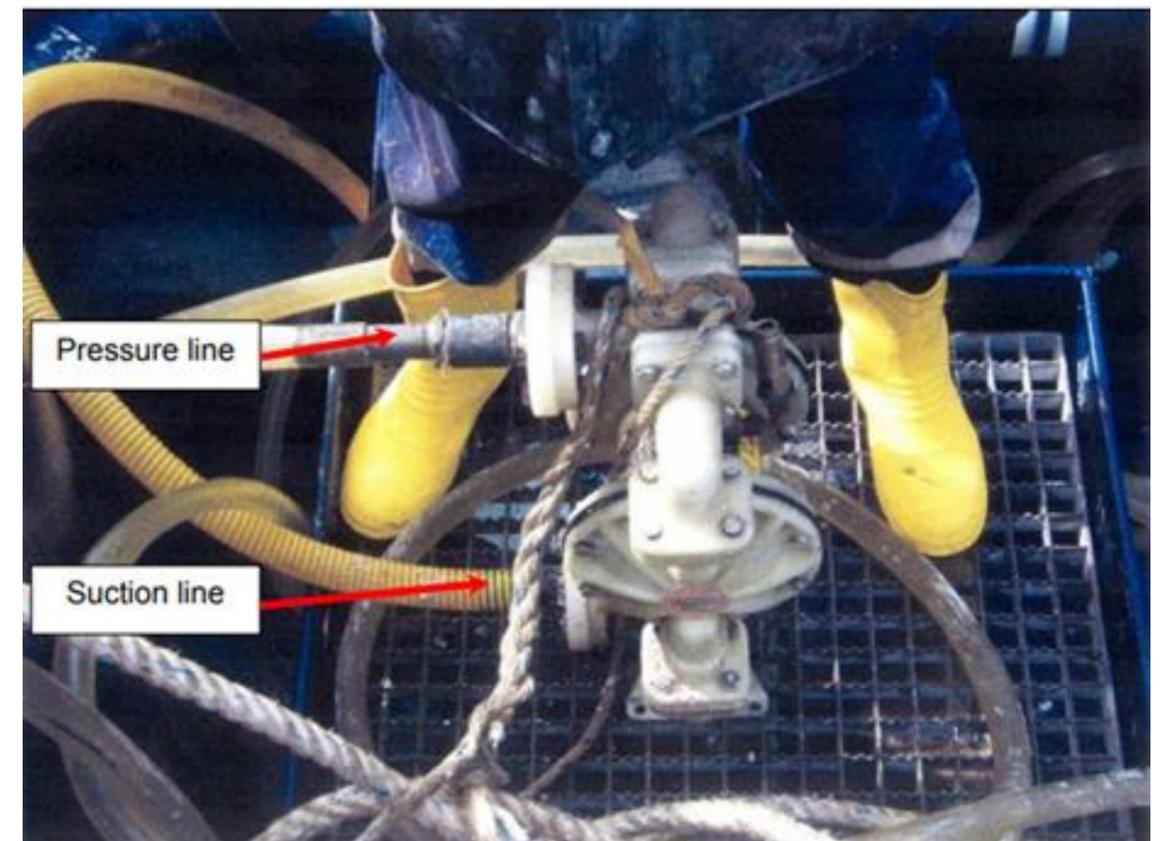
Chemical Burns

BACKGROUND (continued)

- On 29 July, following a successful tank inspection a cargo sample of caustic soda could be finally loaded and circulated through the other tanks in which the cargo was to be loaded.
- After completing a circulation a specimen of the cargo sample was taken.
- The specimen came back as being contaminated and the tanks were again rejected by the tank inspector.
- A 12,162 GT chemical tanker was anchored at a roadstead in the lower reaches of a river and was in ballast condition.
- Therefore, on 30 July the ship relocated back to the roadstead and on 1 August the crew prepared to clean the cargo tanks one more time.

THE INCIDENT

- The cleaning required two crew members to enter tank no. 1 port and remove the residues of the caustic soda that had been used as a cargo sample using a mobile pump.
- For this a polypropylene pneumatic driven pump with a pumping capacity of 520 l/min at a maximum working pressure of 8 bar (Figure 2) was prepared.
- Meanwhile a tank cleaning team consisting of the 3/O and an ordinary seaman (O/S) donned Personal Protective Equipment (PPE)
- The PPE consisted of a cotton overall, a rubberised jacket, safety boots, protective gloves, goggles and a safety helmet.



Pump used on the day of the incident.

Source: Federal Bureau of Maritime Casualty Investigation (BSU)

THE INCIDENT (continued)

- As the tank cleaning team entered cargo tank no. 1 port on its port side. The bosun was located at the coaming of the entry hatch to the cargo tank and
- The master was located at the forward part of the vessel near the tank entrance.
- While the caustic soda was being pumped out from inside the tank, the hose clamp securing the pressure hose to the pump parted.
- This resulted in caustic soda being released into the cargo tank.
- The 3/O was spattered with caustic soda, with a small quantity entering his eyes.
- The O/S requested assistance using his portable radio. The 3/O was safely escorted out of the cargo tank and onto the deck.



Personal Protective equipment worn by the 3/O at the time of the incident.

Source: Federal Bureau of Maritime Casualty Investigation (BSU)

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THE INCIDENT (continued)

- From here the master and the bosun took him to his cabin and initiated first aid by rinsing his eyes with water.
- Meanwhile shore assistance was requested. The injured 3/O was taken to a nearby town by first a rescue lifeboat and then flown to hospital by helicopter.
- He was treated at the hospital for chemical burns and was released after ten days.
- It is unknown whether the injuries sustained have caused any permanent disabilities.
- Following further cleaning and testing following the incident, the tanks again failed the inspection and the chemical company permanently refused to load the cargo.
- Following the incident the tanker's main deck area was noted as being contaminated with a large amount of the previous cargo of palm oil.



Remaining hose clamp on the suction line and a sample clamp.
Source: Federal Bureau of Maritime Casualty Investigation (BSU)

REFLECTIVE LEARNING

The questions below are intended to be used to help review the incident case study either individually or in small groups:

- **What do you think was the immediate cause of the incident?**
- **What other factors do you think contributed to the incident?**
- **What do you think were the barriers that should have prevented this incident from occurring?**
- **Why do you think these barriers might not have been effective on this occasion?**
- **What procedures are available for handling chemicals, such as caustic soda, on your ship? Do these identify the proper PPE to be worn? Is this PPE available on your ship?**
- **Besides from your procedures, what other documentation should you always consult before using any chemicals? And where is this documentation located on your ship?**
- **What information does a Material Safety Data Sheet (MSDS) contain? Who should you ask on your ship if in doubt about the content of an MSDS?**
- **How do you check that your PPE is chemical resistant? Who should you ask on your ship if in doubt?**

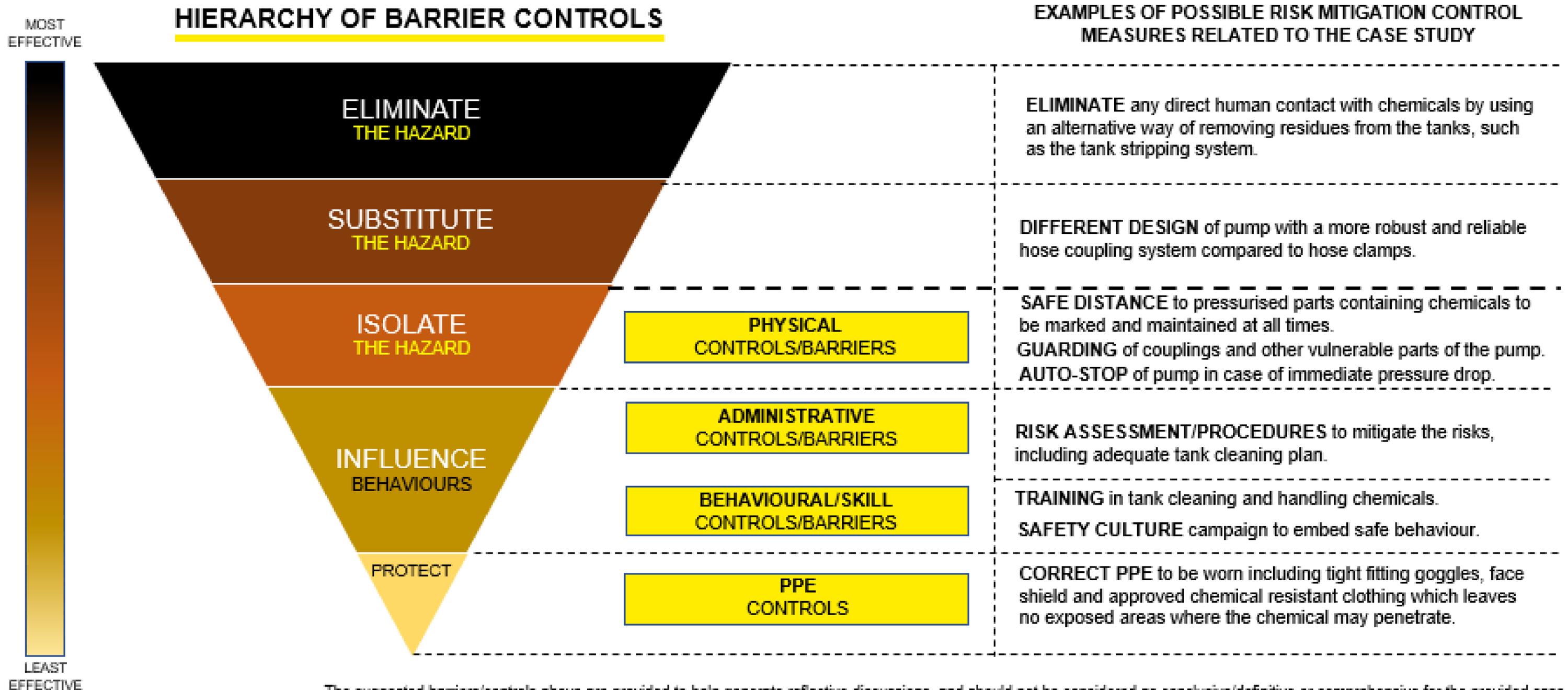
Chemical Burns

LESSONS LEARNED

The following lessons learned have been identified based on the available information in the investigation report and are not intended to apportion blame on the individuals or company involved:

- **PPE** – The PPE worn by the 3/O at the time of the incident were a suitable standard for handling caustic soda.
- **Preparation** – A tank cleaning plan based on a thorough risk assessment was not available following the incident and the investigation concluded that these documents had not been prepared.
- **Intervention** – Although the master and bosun were present as the cleaning team entered the cargo tank, neither of them took any actions with regard to the inadequate PPE being worn by the 3/O and O/S. An effective Stop Work Authority programme would have prevented the incident.
- **Safety culture** – The investigation concluded that the safety management implementation on board did not meet international standards as established safe systems of work were not being followed.
- **Training** – The crew demonstrated a lack of training and capability both in preparing the tanks for the cargo and safely handling the cargo.
- **Condition of equipment** – It remains uncertain whether a case of material fatigue caused the clamp to part. Nonetheless, all equipment should always be inspected prior to use to ensure it is fit for purpose.

Chemical Burns



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.

Chemical Burns

CONCLUSIONS

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 well implemented safety culture had existed on board.

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.

The investigation assumed that the PPE worn at the time of the incident was the PPE typically on board and worn for such work. If so, this may again be indicative of an ineffective safety culture resulting in complacent behaviour. Complacency may have become an increased factor due to the repeated tank cleaning operations in the days leading up to incident believing the PPE being used were of an adequate standard. However, it may also be that the requirement to complete a tank cleaning plan and risk assessment were ignored given the increasing urgency to demonstrate the tanks were in an appropriate condition to load the cargo.

This incident serves as a stark reminder that proper training is essential not only to provide the crew with the correct skillset in order to safely operate a ship, but it also familiarises them with the risks associated with the various shipboard operations thereby increasing safety awareness.

Chemical Burns

QUESTIONS