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ANALYSIS OF MANAGEMENT PRACTICE

FIREFIGHTING WATER TANKER COMMUTING ACCIDENT: CASE REPORT ON WHY IT HAPPENED AND HOW TO MANAGE

Rosnah Ismail[1], Norfaqihah Mohtar[1], Nor Hisham Mohammad[2], Jamri Masran[2], Mohammad Paisal Adam[2], Rizal Abdul Manaf[1]*

1. Department of Public Health Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia, Jalan Yaacob Latif, Bandar Tun Razak, 56000, Cheras, Kuala Lumpur, Malaysia.
2. Fire and Rescue Department of Malaysia, Lebuh Wawasan, Presint 7, 62250 Putrajaya

Correspondence: faqihahmohtar@gmail.com

ABSTRACT

Road traffic accidents represent a significant global public health concern, and Malaysia is no exception. Within the Fire and Rescue Department of Malaysia (FRDM), similar issues have had detrimental impacts on health, financial loss, and service disruptions from 2016 to 2021.

These challenges were highlighted by a recent accident involving a water tanker during a road test, described in this study according to qualitative data from the FRDM accident investigation report. The investigation revealed that human factor, as the active failure, was the primary cause of the accident. Response errors stem from a cascade of latent conditions initiated by inadequate resource management (i.e. provision of training and budget allocation).

To address these challenges, the FRDM should adopt a comprehensive approach to address both latent conditions and active failures. This comprehensive approach ensures that both immediate concerns and root causes are addressed, leading to sustained improvements in safety and operational performance.

KEYWORDS

Commuting accidents; road traffic accidents; firefighter; safety management

INTRODUCTION

Road traffic accidents (RTAs) represent a significant global public health issue, with approximately 1.3 million deaths occurring annually as a result. [1] This issue has also been a concern in Malaysia, where the trend escalated in 2019, resulting in over half a million fatalities in RTAs. [2] The firefighter population globally [3], including in Malaysia, faces these issues. The Fire and Rescue Department of Malaysia (FRDM) experienced an average of 50 accident cases per year. [4] Commuting accidents (CAs) among firefighters have significant and diverse implications for health, finances, and service continuity. Between 2016 and 2021, commuting accidents accounted for 12% of injuries and 1.2% of fatalities among firefighter drivers. Furthermore, the FRDM incurred losses of approximately RM4.5 million due to fines, civil compensatory damages, and expenses related to fire vehicle maintenance. The operational capability of the fire department was compromised due to vehicle damage and the potential for driver injury, death,

or suspension, particularly in incidents involving water tanker accidents. [4] This case report will focus on a water tanker accident to elucidate the dynamic interaction between the driver, the water tanker, and the surrounding environment.

CASE REPORT

In January 2022, a 42-year-old male firefighter driver, with seven years of experience at a fire station in Peninsular Malaysia, was involved in a commuting accident while driving a water tanker during a road test on a state road. As the driver approached a traffic light intersection while descending a hill, the driver gradually reduced the vehicle's speed. However, both the driver and his co-driver were uncertain about the vehicle's speed. As the driver attempted to make a right turn, the water truck unexpectedly lost control, resulting in a rollover and flipping upside down. Fortunately, no other vehicles were involved at the time of the incident. After the collision, the driver lost consciousness for about 20 minutes and regained consciousness while being attended to by the FRDM's Emergency Medical Response Services personnel in their vehicle. He sustained minor bodily injuries, as determined during a medical assessment, and was discharged from the hospital's emergency room on the same day. [5]

A subsequent accident investigation concluded that the primary cause of the collision was a driver-related factor. The driver had not completed specific training for operating the articulated vehicle. Examination at the accident site revealed tyre markings indicating that the driver had consistently applied excessive force to the brake pedal. This suggested that the driver may have been travelling at an inappropriate speed downhill. This presumption was supported by the driver's testimony, indicating his limited knowledge of various braking mechanisms. Instead of engaging the series braking mechanism as recommended, the driver only pressed the brake pedal before turning at a traffic light intersection downhill. Standard practice would involve activating the speed retarder control, shifting gears to a lower level, and gently applying both the pedal brake and trailer brake, as well as the exhaust brake as necessary. [6] The harsh steering manoeuvre when turning further exacerbated the issue, causing the water tanker to become unstable and overturn. As a result of the commuting accident (CA), the driver was suspended from driving duties and received an allowance. Disciplinary action was subsequently taken against the driver for his irresponsible driving behaviour, which resulted in a commuting accident unrelated to emergency response. Additionally, a warning letter was issued to both the fire station head and the officer in charge for failing to provide familiarization training to the driver before permitting them to operate the water tanker. [5]

DISCUSSION

APPROACH TO ANALYSING THE WATER TANKER COMMUTING ACCIDENT.

We believe that this accident occurred due to the interaction between three main factors: the driver, the environment, and the water tanker, rather than solely due to a driver-related factor. The steep gradient downhill of the road topography was environmental factor that influenced the driver's decision to take a series of hasty actions. Moreover, the stability of the water tanker could have been significantly influenced by the water level inside, particularly as substantial sloshing occurred when the vehicle abruptly slowed downhill and traversed road damage at the intersection. Therefore, this case report serves as a pertinent illustration of how the dynamic interaction between humans, the environment, and vehicles can lead to water tanker commuting accidents.

The driver stumbled in determining the appropriate utilization of the braking system while manoeuvring the water tanker on the downhill road. These errors were caused by a previous decision to overlook driver competency. This case replicated the construct set out in the Swiss Cheese Model of Accident Causation (Figure 1). [7] The model demonstrates that the accident resulted from a combination of latent conditions and active failures at various levels of the organization, which coincided temporarily. Unlike active failures, which occur in real-time, latent conditions are often present long before an incident and can remain dormant until they interact with other factors to cause harm. Effective resource management, encompassing competency training provision and budget allocation, directly impacts the capacity to offer pertinent technical knowledge for operating the water tanker. Consequently, substandard practices and response errors may occur among individual drivers during safety-related incidents (Figure 2). Such events pose a considerable risk to the safety and well-being of both the driver and other road users.

FIGURE 1: SWISS CHEESE MODEL OF ACCIDENT CAUSATION

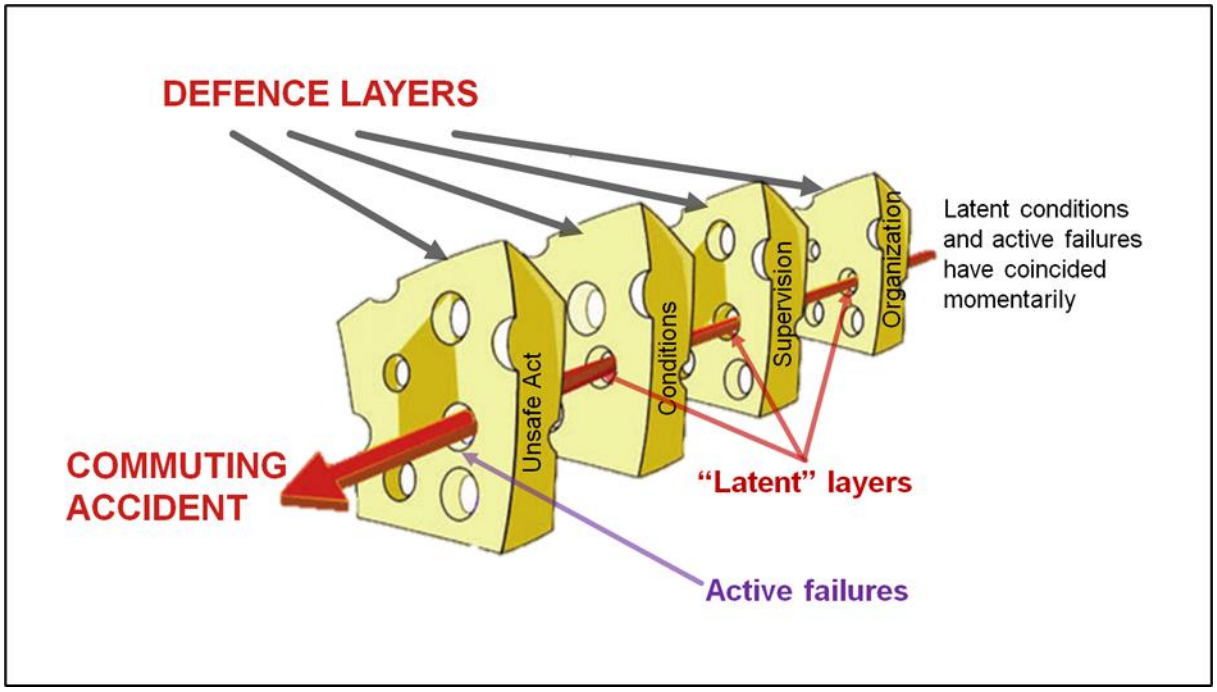
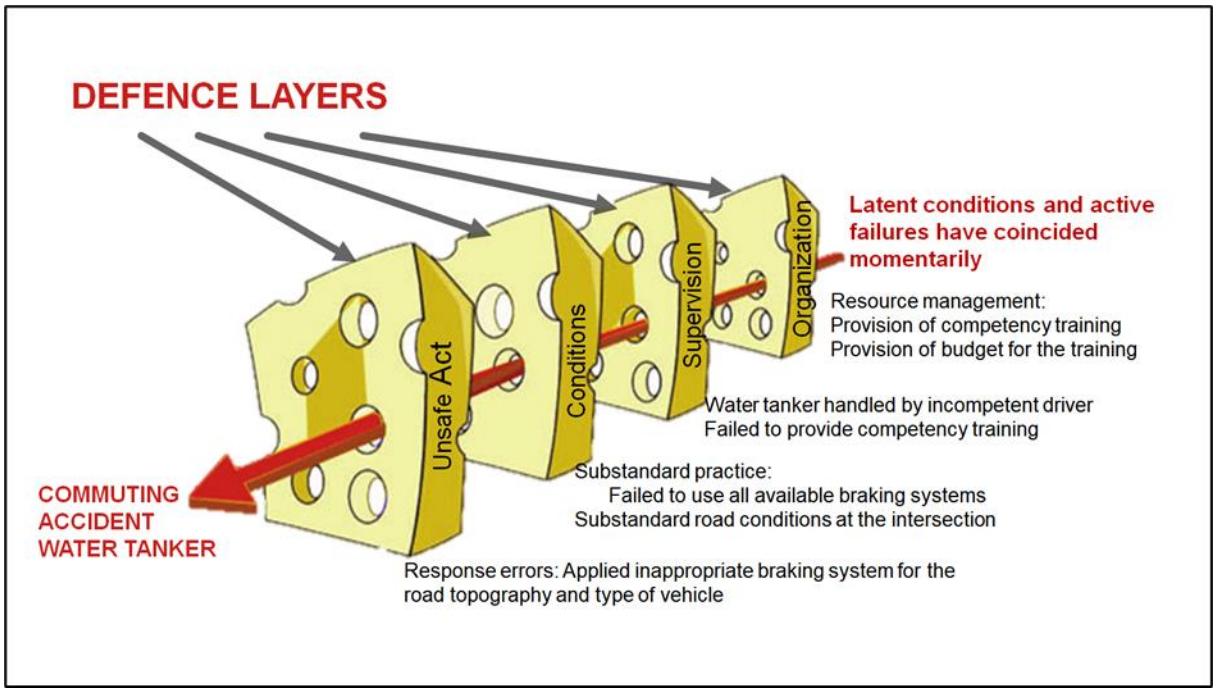


FIGURE 2: LATENT CONDITIONS AND ACTIVE FAILURES LEADING TO COMMUTING ACCIDENT



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MANAGEMENT APPROACHES TO ADDRESS THE COMMUTING ACCIDENT.

Addressing this commuting accident necessitates collaborative efforts from multiple organizational levels to establish sustainable prevention and management measures. These initiatives are essential not only for safeguarding the department's reputation and the safety and health of individual drivers but also for the well-being of public road users, as mandated by the Occupational Safety and Health (Amendment) Act of 2022. [8] Thus, a comprehensive range of effective management strategies is essential to address this issue from safety and health perspectives. Interaction among driver, environment and vehicle significantly plays a significant role in determining the frequency of accidents and therefore requires thorough evaluation. [9,10]

Latent conditions management

Latent conditions management involves identifying and addressing underlying factors within an organization's systems that contribute to the potential for errors or failures. Effective management of latent conditions involves proactive measures such as fostering good resource management to prevent or mitigate their impact on operations. In this case study, resource management stands out as the most critical latent condition to address and improve. Upper-level management bears the responsibility of ensuring sufficient allocation of resources, encompassing financial funding, trainers, and facilities, to facilitate the implementation of articulated vehicle training for all designated drivers.

The accident investigation report uncovered that the driver had not previously attended a specialized driving course, specifically the Articulated Special Vehicle Driving Technique Course for prime movers and tankers. Although the driver had completed the mandatory Emergency Response Driving Training (ERDT), the focus of that course did not primarily encompass driving articulated vehicles. Despite having operated the water tanker for more than five years, the driver had not been directed to participate in the specialized driving course. [5] Given this issue, he had no complete knowledge of the water tanker system, hence increasing the probability of committing an error in manoeuvring the vehicle during the near-crash situation. Therefore, attending specialised driving training for that assigned vehicle is beneficial for drivers to acquire driving ability as well as familiarity with the system and method to operate. [11] It is crucial for the driver to be familiar with the onboard technology of the assigned vehicle, as the technology in a water tanker differs from that in a Fire Rescue Tender. This is because the sense of familiarity directly impacts the speed and accuracy of responses when operating a vehicle in an emergency or near-crash scenario. It helps direct the driver's attention towards locating hand- and foot-operated controls where they expect them to be, thereby reducing the likelihood of being involved in a vehicle accident. [12] A few studies have found similar situations. [13–15] The hand and foot-operated controls differ according to type of vehicle. Firefighting water tanker has a complex braking system, comprising a retarder, exhaust brake, gear shifting, trailer brake, pedal brake, and hand brake. Hence, it is imperative to periodically enhance the driver's familiarity with the assigned vehicle by the best practices established by the organization. Naturally, this entails a significant budget allocation.

Given financial and resource limitations, mentoring emerges as a cost-effective training approach to instil safety-critical knowledge and skills within a shorter time frame. This method reduces the necessity for drivers to allocate extensive time away from work for lengthy courses. Furthermore, mentoring can efficiently support drivers in achieving peak performance while ensuring the continuity of their training. [16] However, the practicality of this training hinges on its inclusion in a policy or standing order mandating that all drivers receive adequate training, with proper documentation. The aforementioned advantages of specialized driving training diminish the probability of driving errors and, consequently, involvement in commuting accidents. The repercussions of such accidents extend beyond the health of the implicated driver, often resulting in sustained injuries. Additionally, they subject drivers to the risk of severe penalties, particularly if the accident leads to permanent injury or death of civilian drivers.

Active Failures Management

Management of active failures involves identifying, addressing, and mitigating errors or failures occurring in real-time while driving water tanker. This management approach focuses on promptly recognizing and resolving issues to prevent them from escalating into more significant problems or accidents. While enhancing resource management is crucial for mitigating subsequent inherent latent conditions at the supervisory and operational levels, individual drivers are also expected to proactively acquire knowledge and adhere to safe work practices autonomously when handling water tankers. The design of a firefighting water tanker poses a risk of significant accidents due to the kinetic force generated by the water sloshing front/back, especially during slowing down, corners or turns. The considerable volume of water, totalling 20,000 Liters, significantly amplifies the greater risk of rolling over, as they have a higher centre of gravity, due to the liquid sloshing while driving downhill. Indeed, while interior baffles significantly reduce the slosh factor, it is imperative to conduct thorough assessments of the condition of water tankers before, during, and after driving to ensure safety and prevent accidents. This process involves implementing a comprehensive checklist to assess various aspects of the tanker, including but not limited to:

- Inspection of the braking system and tanker
- Check for leaks or damages to the tanker body
- Verification of tyre pressure and tread depth
- Assessment of water levels

- Examination of lighting and signalling systems
- Examination of steering and suspension components
- Assessment of windshield visibility and wiper functionality
- Confirmation of proper functioning of safety features
- Inspection of reflective markings for visibility
- Evaluation of overall vehicle condition and cleanliness.

By adhering to a detailed checklist and conducting regular assessments, the objective of ensuring the safety and reliability of water tankers can be effectively achieved. During driving, it's crucial to continually assess additional surrounding road conditions such as road damage, traffic flow (i.e. observing the movement and behaviour of other vehicles to anticipate potential hazards or changes in traffic patterns), signage (i.e. road signs and markings), visibility, and land topography (observing changes in terrain, elevation, curves, and slopes that may impact vehicle handling and control). Road damage or design flaw, and visibility are officially listed as the causes of road crashes in Malaysia. [17] The presence of roads with potholes, cracks, uneven surfaces, or debris hazards have been frequently observed and reported in the media as factors leading to the loss of vehicle control and subsequent accidents.

Provision of psychological support for return to work

Commuting accidents not only caused physical injuries but it also resulted in mental and emotional disruption that can negatively impact daily or working life. [18] Therefore, in addition to physical examination follow-up, his post-commuting accident continuation care should encompass psychological screening and support. It is essential to screen for mental health status as part of acute management because of the probability of the risk of developing post-traumatic stress disorder (PTSD), particularly following this high-impact accident. [18]. Incorporating a minimum of one-year driving suspension for the driver may prove advantageous, as it allows emotional recuperation and improved overall functioning after the traumatic incident. This is because symptoms of PTSD may appear immediately after an accident, or they may take up to a year to manifest. [19] Although driving suspension may initially appear as a harsh penalty for the affected driver, it can serve as a form of psychological recovery. It has the potential to reduce the duration of PTSD and defer psychological traumatization disorder. Clear communication regarding these potential benefits should be effectively conveyed to the driver to encourage acceptance of the penalty and positively influence their return to work. [20]

CONCLUSION

In conclusion, while accidents involving water tankers may be infrequent, their occurrence can have significant adverse effects not only within the fire department but also on the environment and public safety. This case report, although limited in scope, underscores the importance of future analytical research to identify factors contributing to accidents and enhance risk management strategies. Effectively managing and preventing commuting accidents among firefighter drivers requires a comprehensive approach that integrates safety and health perspectives while considering the dynamic interaction between humans (drivers), vehicles, and the environment. Robust policies, along with the commitment and collaboration of all organizational levels, are essential for achieving sustainable improvements in occupational safety and health management within the fire department. (Words:2215)

ETHICAL CONSIDERATIONS

The study on commuting accidents in firefighters conducted at Fire and Rescue Department of Malaysia was approved by the Research and Ethics Committee of the Faculty of Medicine, Universiti Kebangsaan Malaysia (UKM PPI/111/8/JEP-2022-424). Permission to report a case of a water tanker commuting accident was obtained from the Fire and Rescue Department of Malaysia, with reference number JBPM/IP/OPS: 600-7 (24).

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COMPETING INTERESTS

The Authors declare that there is no conflict of interest.

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