UNIVERSITY OF CAPE COAST

# OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEMS (OHSMSs) FOR FUEL TRANSPORTATION IN GHANA

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# OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEMS (OHSMSs) FOR FUEL TRANSPORTATION IN GHANA

BY

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# DECLARATION

## Candidate's Declaration

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's signature: ……. Date: …….

Name: Steve Amoako Baafi

## Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised following the guidelines on supervision of thesis laid down by the University of Cape Coast.

Supervisor's Signature: …….. Date: ……...

Name: Dr. Edward Kweku Nunoo

## ABSTRACT

Accidents have been identified as one of the most pressing social challenges in recent years. Even as the oil and gas industry is seen as one of the lucrative sectors in Ghana, the repercussions of interruptions in the transportation process of these highly flammable materials have cost Ghana a lot. Thus, accidents related to the transportation of these harmful substances by road have claimed many lives and threatened the environment, such as towns along the Kumasi-Accra highway (N6). Hence, this study aims to assess the efficiency for the adoption and implementation of Occupational Health and Safety Management Systems (OHSMSs) for fuel transportation in the downstream oil and gas industry along the Kumasi-Accra highway (N6). The study used the quantitative methods research design. First, the target population for the study were 200 fuel truck drivers from JK Horgle Company Limited. Next, out of the target population, 132 respondents were simple randomly sampled to answer a survey questionnaire. After the analysis was completed by utilising the ISO 45001 and Statistical Product for Social Sciences (SPSS v26), it was revealed that JK Horgle Company Limited had high compliance with the adoption and implementation of the current ISO 45001 standard, hence resulting into no loading and fuel transportation disruptions. Therefore, the study concluded that this institution's OHSMSs comply with best practices. Because of the findings, it is recommended that fuel transporting companies should have fuel truck drivers who have solid background, better conditions of fuel trucks and obtain all necessary conditions liable to fuel transportation mishaps.

**KEYWORDS**

Fuel Transportation

Ghana

ISO 45001

Occupational Health and Safety Management Systems

Safety Culture

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## DEDICATION

To my lovely parents Mr. Victor Baafi and Mrs. Margaret Owusu and all my siblings

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| ACSNI | Advisory Committee on Safety of Nuclear Installations |
| ANP | Analytical Network Process |
| APD | Accra Plains Depot |
| BECE | Basic Education Certificate Examination |
| BOST | Bulk Oil Storage and Transportation |
| BRV | Bulk Road Vehicle |
| GOIL | Ghana Oil Company |
| IAEA | International Atomic Energy Agency |
| ISO MSS | International Organisation for Standardization Management System Standard |
| ISO | International Organisation for Standardization |
| LNG | Liquified Natural Gas |
| OHMS | Occupational Health Management System |
| OHS | Occupational Health System |
| OHSAS | Occupational Health and Safety Assessment Series |
| OHSM | Occupational Health and Safety Management |
| OHSMF | Occupational Health and Safety Management Frameworks |
| OHSMS | Occupational Health and Safety Management System |
| OHSMSs | Occupational Health and Safety Management Systems |
| PDCA | Plan-Do-Check-Act |
| PPE | Personal Protective Equipment |
| S_OHSMS | Sustainable Occupational Health and Safety Management System |
| SPSS/PC | Statistical Package for Social Sciences/Personal Computer |

| | |
|---|---|
| SSCE/WASSCE | Secondary School Certificate Examination/West African Secondary School Certificate Examination |
| TOPSIS | Technique for Order Preference by Similarity to Ideal Solution |
| WHO | World Health Organisation |

# CHAPTER ONE

# INTRODUCTION

## Background to the Study

According to Mohammadi, Mohammadzadeh, Ahmadi and Esmaeili (2017), accidents have been identified as one of the most pressing social challenges in recent years. Thus, according to Liu, Nkrumah, Akoto, Gyabeng and Nkrumah (2020), these accidents both past and present, result from the absence of or poor implementation of occupational health and safety management systems (OHSMSs). Again, as accidents can occur in any aspect of any industry, health and safety apply to all phases of that industry, including production projects, facility operations, maintenance, building, transport and storage (Achaw & Boateng, 2012).

All industries, including the oil and gas industry, face enormous risks and many more challenges due to lousy safety set-up, absence of capital for safety arrangements, the hefty quantity of non-qualified occupational health experts, scarce occupational health and safety (OHS) job-related accident and damage supervisory strategy and the absence of health and safety facts (Amponsah-Tawiah & Dartey-Baah, 2011; Achaw & Boateng, 2012) making occupational health and safety management system inescapable in Ghana's oil and gas industry. Both employers' and employees' health, safety and welfare are essential (Obese, 2010). Obese added that the law mandates that employers to guarantee their employees' health, safety and welfare. Obese further positioned that ensuring the health, safety and interest, employee accidents, absenteeism and personal problems that have a high chance of affecting the value of work to lessening productivity are all reduced. Thus, according to

Amponsah-Tawiah, Ntow and Mensah (2016), occupational health and safety management (OHSM) holds an important place in every worker's life. Occupational health and safety management (OHSM) can encourage workers to adapt to the working environment, therefore promoting and maintaining a high extent of employees' physical, mental and social well-being in all occupations (Armstrong, 2006).

The transportation of hazardous materials like hydrocarbons is among the world's most dangerous events (Torretta, Rada, Schiavon & Viotti, 2017). According to Qureshi, Hafeez and Kazmi (2020), they can cost catastrophic damages and lives when not managed. As said by Khan and Abbasi (1999), incidents regarding the interruption of the fuel transportation process have the most significant number of deaths.

Notable occurrences are the 1978 disaster in Las Aflaque, Spain, which claimed 217 lives (Arturson, 1981). In addition to this, the oil tanker explosion which occurred in Ahmedpur Sharqai in 2017 also claimed 219 lives in Pakistan (Qureshi et al., 2020). Zhu and Srinivasan (2011), Uddin and Huynh (2017) also reported that in the global ranking, fuel tankers and trucks are the chief causes of accidents mainly because of their magnitudes and exceptional traits.

However, according to Lau (2006), Kalayi (2006), developing countries have recorded several interruptions in fuel transportation with a significant amount of losses, including lives: plants, animals and humans, properties and environmental damage. For example, a recent fuel tanker explosion occurred in south Kivu – Congo – with 230 casualties and another fuel tanker explosion in Okibie – Nigeria – with 121 deaths (Qureshi, Hafeez & Kazmi, 2020).

According to Olagunju (2010), "from 2007 to 2010 about 4,076 fuel tanker truck-related fatalities were recorded in Nigeria, with 1,221 deaths in 2008 alone." Despite the fact that Ghana has benefited greatly from the oil and gas sector (Arthur & Amo-Fosu, 2020), Ghana has suffered significant losses as a result of mishaps in the delivery of these highly flammable products (Agbenorku, Akpaloo, Farhat, Hoyte-Williams, Yorke, Agbenorku & Neumann, 2010). The paragraphs below state a few notable occurrences in Ghana:

According to Agbenorku, Akpaloo, Farhat, Hoyte-Williams, Yorke, Agbenorku & Neumann (2010), a fuel tanker on August 23, 2008, at 'Atwidie' in the Asante Akyem North District of the Ashanti Region of Ghana overturned and exploded. The flames spread across nearby residents, leaving five dead and six hospitalized due to sustained injuries. Again, Agbenorku et al. (2010) added that on November 26, 2008, a petrol truck at Techiman in the Brong-Ahafo Region, now Bono East Region of Ghana, overturned and the petrol leaked. Worried about someone taking away the vehicle's battery, the driver's 'mate' tried to salvage the battery, where it ignited and burned all who were scooping the petrol. Unfortunately, 31 people died on-site and 16 of the 26 people admitted at the Komfo Anokye Teaching Hospital (KATH) died later.

Additionally, Agbenorku et al. (2010) continued that a petrol tanker toppled on August 22, 2008, near Adum, the business hub of Kumasi in Ghana's Ashanti Region and its petroleum spilt 300 metres down a hill along the side of a road. It was added that three people lost their lives and five people were hospitalised due to sustained injuries when the petrol caught fire from a burning stove where a lady was preparing food. Again, Meteku, Ankudey and Ocran

(2019) shared a similar incident when on January 17, 2017, an LPG tanker had a near-fatal disaster of enormous magnitude on the Tema Motorway but the Ghana Fire Service's timely intervention prevented the occurrence of the disaster.

Similarly, according to Ansah (2021), on Monday, May 24, 2021, a petrol fuel truck travelling from Kumasi to Tepa collapsed and burned approximately half of the village of Onyina Nofo in the Ashanti Region's Ahafo Ano South West District. Ansah added that the fuel tanker driver failed to negotiate a sharp curve due to his acceleration, overturning and killing himself, his driving colleague and a two-year-old boy in the village. Ansah furthered that this tragic tragedy left more than half of the village's people homeless with numerous others in severe condition in hospitals. Also, according to Asamoah (2021), a fuel truck driver collided with two oncoming vehicles in the opposite lane on Friday, June 4, 2021, in an attempt to avoid another car. This accident on the Tema Motorway claimed one life and injured seven others. Finally, according to Ayitey (2021), on the following day, Saturday, June 5, 2021, a fuel tanker lost control and crashed into a tipper truck carrying sand on the Tema Motorway. Although no casualties were reported, the accident created significant hazards for other road users, including pedestrians and other vehicle drivers, as well as massive traffic congestion on the Tema Motorway until Police and the Fire Services Personnel arrived.

In conclusion, Achaw and Boateng (2012) highlighted the importance of occupational health and safety management in Ghana due to the mishaps in transportation process and the impact on life, property and the Ghanaian economy. However, as stated by Torretta, Rada, Schiavon and Viotti (2017), no

individual can ever prevent the risks related to the transportation of highly flammable substances, though, the transport of such substances will always go to areas of need. Johnston (n.d.) recommended that a vital thing to do in today's oil and gas industry is to ensure a sustained effort to maintain health and safety and control accidents concerning the transportation of these harmful substances.

**Statement of the Problem**

Fuel transportation in Ghana, precisely on the Kumasi-Accra Highway (N6) is challenged by occupational health and safety management issues that need to be addressed. The transportation of oil and gas on the Kumasi-Accra Highway (N6) is challenged with high risks. Among the N6 incidents are what happened in Pokuase, New Jejeti and Amanfrom. According to Abbey, (2014), the Pokuase incident occurred between a fuel tanker, a school bus and a '207' commercial vehicle on November 24, 2014. Abbey continued that, upon collision, the tanker and the school bus caught fire. Still, fortunately, all occupants on all vehicles escaped unhurt except for a few students who, in an attempt to jump out of the school bus to safety, sustained some bruises (Abbey, 2014).

Another incident occurred at New Jejeti near Nkawkaw on May 31, 2019, where a diesel tanker overturned (Adom TV, 2019). The spillage from the fuel truck had a high propensity in threatening the environment and residents, especially those who jostled for fuel at the crash site (Adom TV, 2019). Again, another accident happened in Amanfrom, a suburb in Nkawkaw within Ghana's Eastern Region (Adom TV, 2020). On June 26, 2020, according to Adom TV, a fuel tanker containing petrol overturned and spilt. Adom TV further reported that the driver and his 'mate', upon sustaining severe injuries,

were rushed to the nearest hospital. However, residents and other drivers who rushed to scoop some of the fuel were at high risk of explosion for their actions due to the spillage (Adom TV, 2020). Hence, it is worthy of note that a work such as this that examines the issues leading to these accidents regarding fuel transportation and proffers empirical recommendations towards curbing the menace cannot be overemphasised.

Again, the operational conditions, chemicals and end-products (hydrocarbons and other compounds) associated with the oil and gas industry pose serious health and safety threats to workers making occupational health and safety management indispensable in the oil and gas industry (Chuahan, 2013). Therefore, it is no surprise that the industry's health and safety management issues have attracted much attention in the literature. Moreover, (Horbah, 2020; Liu, Nkrumah, Akoto, Gyabeng & Nkrumah, 2020) have given a recommendation on the need to have existing and improved occupational health and safety management systems to prevent the occurrence of occupational incidents in Ghana. Unfortunately, although Ghana now has a national health and safety manual to guide the oil and gas industry operations, there are lapses or no clauses regarding the safe transportation of hazardous substances such as hydrocarbons and their derivative products (Ministry of Energy, 2019).

Moreover, added to the absence of clear legislation regarding the safe transportation of hydrocarbons is the inexistence of literature on hydrocarbon transportation and safety issues in Ghana. Even though it is an indubitable fact that OHS in the oil industry has attracted a wide array of literature (Yirenkyi, 2017; Ansah & Mintah, 2012; Obeng-Odoom, 2018; Oppong, 2016; Arthur,

Owusu & Ahiable, 2019; Abdulai, 2016; Horbah, 2020) across the upstream, the midstream and the downstream, these studies did not address OHS with regards to the transportation of oil and gas that have been noticed in the forgone paragraphs to have been confronted with many road accidents.

More so, accident causation models explain the environment to only include road infrastructure (Cleveland State University, 2001; Laaraj & Jawab, 2018), however, the weather has a substantive impact on fuel transportation on Ghana's roads.

From the above, it is clear that a dearth of knowledge exists in occupational health and safety regarding fuel transportation accidents in Ghana, specifically on the Kumasi-Accra highway (N6). Therefore, the study is motivated to examine the occupational health and safety management systems for fuel transportation in Ghana.

**Purpose of the Study**

The study's goal is to assess the efficiency for the adoption and implementation of occupational health and safety management systems for fuel transportation in the downstream oil and gas industry along the Kumasi-Accra Highway (N6).

**Objectives of the Study**

The study specifically sought to:

1. Examine the background of fuel truck drivers who ply the Kumasi-Accra Highway (N6).
2. Assess the conditions under which fuel trucks ply the Kumasi-Accra Highway (N6).

3. Analyse the conditions that influence fuel transportation disruptions on the Kumasi-Accra Highway (N6).

**Research Questions**

1. What is the background of fuel truck drivers who ply the Kumasi-Accra Highway (N6)?
2. What are the conditions under which fuel trucks ply the Kumasi-Accra Highway (N6)?
3. What conditions influence fuel transportation disruptions on the Kumasi-Accra Highway (N6)?

**Significance of the Study**

The research into the Occupational Health and Safety Management Systems (OHSMSs) in Ghana's fuel transportation will be valuable for upstream and downstream oil and gas stakeholders (investors, researchers, contractors and clients in the industry). This is because the study will provide sufficient information concerning the prevention of fuel transportation accidents to stakeholders in order to secure their assets – employees (drivers and their 'mates'), fuel and fuel trucks. In addition, the study will serve as a reference material for policymakers to make quality decisions regarding health and safety relating to fuel transportation in the oil and gas industry. Finally, it may serve as a body of knowledge for further research.

**Delimitation**

According to Punch (2013), it is essential to define a study to manage and understand a research topic properly. Therefore, the researcher defined the study to JK Horgle Company Limited, meanwhile, there exist other fuel transportation companies such as S. O. Frimpong Transport Company Limited,

Riet Transport Company Limited and J. K. Ahaidome Company Limited. JK Horgle Company Limited was the only studied fuel transporting company for the study because according to BOST, JK Horgle Company Limited is the main fuel transporting company with whom it shares contractual relations with. Moreover, the study was more delineated to the Kumasi-Accra Highway (N6).

**Limitations**

Although the study has several strengths, it also contained some shortcomings. First, the respondents to the study were not given the opportunity to express themselves freely because the data were collected through the use of a questionnaire. Consequently, the study did not investigate each construct in detail. Due to respondents' perception that the exercise was a waste of time, some of the respondents were unwilling to cooperate. Moreover, this research considered only JK Horgle Company Limited which could have a limitation on the generalization of results. Lastly, the utilisation of only the Kumasi-Accra Highway (N6) could affect the generalisation of outcome over all highways in Ghana.

**Definition of Terms**

**Occupational Health and Safety (OHS)**

According to Bacchetta (2007), OHS is a condition and factor affecting workers' health and safety or any other individual in the working environment.

**Safety Management System (SMS)**

Ming (1994) defined safety management systems as "the policies, objectives, organisation, management controls and resources which are in place to manage safety, health and environment in all parts of the business."

**Occupational Health and Safety Management System (OHSMS)**

According to NSF (2020), "ISO 45001 is a new international standard that provides a framework for an organisation to manage risks and opportunities to help prevent work-related injury and ill health to workers."

**Organisation of the Study**

This thesis comprises five chapters, with each chapter focusing on a particular area. The study's background, the problem statement, the purpose of the study, the objectives of the investigation, the research questions, the significance of the study, the delimitation, limitations and the organisation of the study are all covered in Chapter one. The review of literature relevant to the study is the focus of Chapter two. It deals with the theoretical framework, in-depth definition of the various concepts: safety management system, occupational health and safety and occupational health and safety management system and the empirical review. Chapter three delivers information on the methodology for the study. It deals with the research design, research philosophy, study area, target population and sample and sampling procedure. The third chapter again looks at the data collection instrument, data collection procedure, data processing and analysis and ethical consideration.

The fourth chapter reports the findings gained from the field, including the discussions. It presents the results and discussions. The final chapter summarises the salient trends and ends with suggestions and recommendations necessary to prevent the adverse consequences of fuel transportation system's disruptions on the Kumasi-Accra Highway (N6) in Ghana's downstream oil and gas industry.

# CHAPTER TWO

# LITERATURE REVIEW

## Introduction

This study reviews the relevant literature on Ghana's fuel transportation's occupational health and safety management system (OHSMS). This chapter presents the fundamental viewpoints of this research's focus and serves as its development foundation. Given this, the researcher focused on three main parts in this chapter. The first part concentrated on the study's theoretical review, where the researcher explained the theories necessary for discussion. The next part emphasized the study's conceptual framework, including the concepts and critical terms in the topic. Finally, the empirical review of the research took the third section.

## Theoretical Framework

Like other disciplines, occupational health and safety has a theoretical framework (Obese, 2010). Obese postulated that this theoretical base serves as a form of information that allows OHS researchers and experts to make generalisations rather than otherwise. Obese (2010), DeCamp and Herskovitz (2015) added several theories on OHS: the Systems Theory Model, Heinrich Domino Theory, the Human Factor Model and the Swiss Cheese Model. However, this study focused on the Systems Theory Model because it perfectly addresses the objectives of the study.

## Systems Theory Model

According to DeCamp and Herskovitz (2015), the Systems Theory deals with a combination of three components. DeCamp and Herskovitz added that these components are the;

a. Environment

b. Human and

c. Machine

DeCamp and Herskovitz (2015) again posited that the Systems Theory reveals a harmonious existence among the environment, the human and the machine rather than the human prone to errors or the atmosphere full of hazards. This harmony makes the chances of an accident occurring very low. However, an accident significantly occurs when there exists a deviation in either one or more of the components caused by someone or something (DeCamp & Herskovitz, 2015).

Laaraj and Jawab (2018) positioned that focusing on the whole system makes this approach unique. According to Van Elslande (2003), the driver, the chief road user, has always got to make the decisions and is the heir of the system's errors, contributing to the development of failures. Similarly, Hardy (2010) added that the system's universal purpose is to recognize the various components, focus on the entire system and the relationship between the elements and their environment. The abovesaid makes applying the systems approach possible to real-world situations or problems, considering its complex nature (Laaraj & Jawab, 2018).

Similarly, Hardy (2010) asserted that all systems' components interact and act on any of its elements, which has repercussions on the whole system. Hardy continued that any variation in the system results in the components constituting the design to alter the connections between them. Again, Hardy added that the systems approach considers the changing nature of the complex system and permits a better understanding of these interactions' hearts and

features to accurately act on the appearance of failures within the system to avoid or reduce the accident's intensity.

Santos-Reyes and Beard (2002) contended how practical the systemic approach would be to assess the effectiveness of existing safety management systems. Again, Santos-Reyes and Beard hammered the need to use the systemic approach to appreciate fire safety's systemic view. However, according to Brusque, Bruyas, Fabrigoule, Hamelin, Hours, Lagarde and van Elslande (2011), the interactions between the systems' components and its environment are more likely to cause obstacles and problems in a complex system like the road system.

Figure 1 is a systems model representing the normal interaction of the driver, the vehicle and the environment in the fuel transportation system.

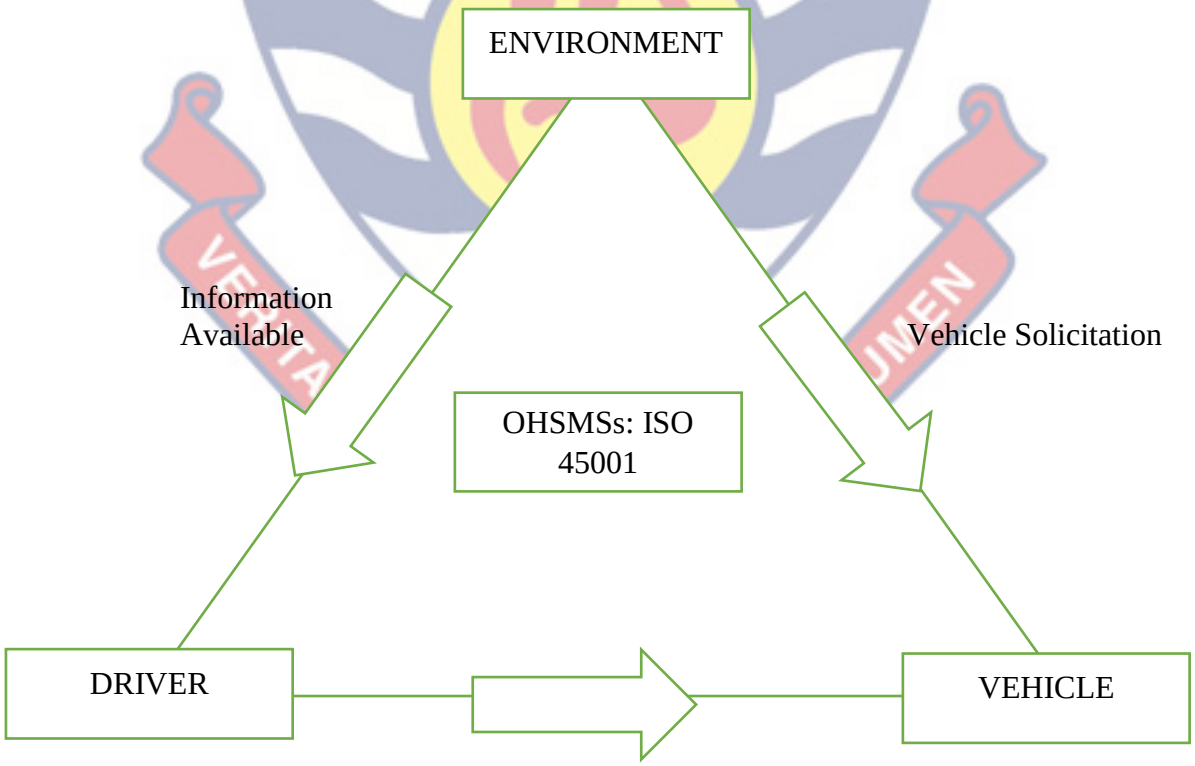


*Figure 1*: Driver – Vehicle – Environment Nexus for Fuel Transportation

Source: Based on Van Elslande (2003) model.

***The Environment***

In the framework. the environment is explained as solely road infrastructure in accident causation models (Cleveland State University, 2001; Laaraj & Jawab, 2018); yet, the weather significantly impacts fuel transportation (Camden et al., 2020). Road transportation infrastructure has an economic impact that cannot be overstated (Gelete & Gokcekus, 2018). Gelete and Gokcekus continued that they expect highway transport of about roughly 70% of all commodities. Gelete and Gokcekus added that climate change, on the other hand, has many negative consequences for road infrastructure. According to Atampugre, Larbi, Ojo and Liu (2020), they could expect that more frequent and severe floods and storms in the road transportation subsector could result in multiple flooding (degradation and degeneration) of transport infrastructure risks to passenger and freight safety. Atampugre et al. (2020) added their expectation of increased storm events resulting in landslides on road networks in mountainous locations, causing road accidents. As a result of rising temperatures caused by climate change, asphalt roads can crumble within a short period after being built (Gelete & Gokcekus, 2018).

According to Camden et al. (2020), significant sunlight is a weather influencing factor that makes road travel difficult. Furthermore, heavy rain causes new routes to develop potholes while existing ones deepen quickly and easily (Twerefou, Adjei-Mantey, & Strzepek, 2014). Again, temperature increase, coupled with increased radiation from the sun's energy, may reduce the life span of dark road surfaces (Taylor & Philp, 2010). The interruption of road transport processes has ramifications for system efficiency, as it may result

in higher costs in terms of wasted time, increased transportation costs and increased maintenance costs (Boateng, 2012).

***The Driver***

According to Camden et al. (2020), occupational drivers mostly use the Smith System as a defensive driving program. Camden et al. (2020) added that the Smith System's primary purpose is to assist drivers in anticipating and promptly reacting to driving dangers to avoid collisions. Camden et al. (2020) continued that to accomplish this; the Smith System focuses on five essential principles, which are:

*Aim high in steering*

To anticipate and analyse potential threats, drivers must glance further down the road, at least 15 seconds ahead. Drivers can detect risks and respond in time to avoid accidents if they gaze at least 15 seconds in advance.

*Get the big picture*

Drivers must be able to view the whole road. This view includes their vehicles' sides and backs. Every 5–8 seconds, drivers should check their mirrors. In addition, drivers must increase their following distance to avoid creating impediments by following vehicles too closely.

*Drivers should keep their eyes moving*

Drivers should keep a continual eye on their surroundings while driving. Drivers should avoid fixating on things, scan new items every two seconds and reduce distractions to improve visual scanning.

*Leave yourself an out*

To avoid an emergent hazard or an accident situation, drivers should control the space surrounding their vehicle.

*Make sure other drivers and road users see you*

Drivers should employ warning signals with other vehicles and road users, such as eye contact.

***The Vehicle***

According to Camden et al. (2020), familiarizing yourself with the vehicle, examining the truck before trips and correct tire chain use are all things the driver should consider. Camden et al. (2020) added that drivers should be more familiar and put the vehicle to use.

In relation to this study, road accident involving fuel transportation is expected to be low in areas where fuel drivers embrace the systems' approach by learning to apply every bit of it, keeping in focus the infrastructural layout of the road and the atmospheric condition under which transportation is undertaken such as encompass the environment mentioned of in the systems theory, putting into effect the five essential principles that allow the driver to anticipate and react promptly to any emergent accident and familiarizing themselves as drivers with their vehicle while maintaining a high level of serviceability of the vehicle. Correspondingly, it is expected that many road accidents in connection with fuel transportation should result from the poor application of the Systems Theory discussed above.

**Heinrich Domino Theory**

DeCamp and Herskovitz (2015) explains this theory as the analogy of dominoes falling on top of one another and setting off a series of events causing accidents. DeCamp and Herskovitz continued that each domino that topples causes the next to be pushed over and so on, until all of the connected dominoes have done the same. However, they added that the entire process comes to an end if only one domino is taken out. Here, it falls on the driver to eliminate all necessary conditions that will likely lead to accidents. These necessary conditions could be on the fuel trucks (vehicle) and/or the environment. For a detail explanation, DeCamp and Herskovitz proposed five steps of accident causation for this theory. The stages are as follows:

**a. Social Environment and Ancestry**

Anything that could cause a person to develop unfavourable qualities is included in this stage. It is important to keep in mind that Heinrich's inclusion of genetics and ancestry is very much a result of the time it was written. This idea might be updated to include the term "inherited behaviour," much like how alcoholism and temperaments can be passed through generations.

**b. Faults of a person**

This stage relates to individual traits that increase the likelihood of accidents. For instance, a bad temper might cause irrational outbursts and a disregard for safety. Similar to this, being generally careless can also be a sign of bad character. This stage also includes ignorance, which includes not knowing safety standards or standard operating practices.

**c. An unsafe act or condition**

This stage frequently marks the start of a particular incident. This stage is more closely tied to the accident than the first two, which have an impact on the likelihood of accidents happening. This can include a specific harmful conduct, such as starting a machine without giving it enough time to warn you, or failing to take the necessary precautions, such employing guardrails or other safety measures. Basically, this stage comprises actions (or inactions) that occasionally result in accidents.

**d. The accident**

This is the stage the accident itself occurs. This is when something unintended and unwanted happens.

**e. Injury**

This is the stage where the accident leads to an unfortunate consequence.

**Human Factor Model**

According to DeCamp and Herskovitz (2015), an accident is something that happens as a result of a human error. In order to explain this hypothesis, DeCamp and Herskovitz made the supposition that accidents are the result of a single person. In this case, the accident only occurs when the driver commits a mistake and vice versa. The mistake could be committed on the fuel truck (vehicle) and/or the environment.

**Swiss Cheese Model**

According to DeCamp and Herskovitz (2015), every step in this theory's suggested procedure has the potential to fail. A slice of Swiss cheese is used to represent each layer of protection and the holes in the cheese stand in for any potential flaws or faults in that layer. Active and latent failures are the two

different kinds of failures that might happen (DeCamp & Herskovitz, 2015). Unsafe behaviours known as active failures directly cause accidents. There is a condition called latent failure, which may go unnoticed for a while before causing an accident. For an accident to happen, the holes must line up; no line of defence can stop the problem. If the holes do not line up, the problem has already been identified, preventing an accident. Here, any loose ends committed by the driver have a chance to lead to catastrophic consequences. These loose ends could be on the fuel trucks (vehicle) and/or the environment.

## Conceptual Review

### Occupational Health and Safety (OHS)

According to Bacchetta (2007), OHS is a condition and factor affecting workers' health and safety or any other individual in the working environment. According to Leka (2003), OHS is multidisciplinary and touches on psychology, medicine, technology, economics and law. Its broad nature captures the employee's physical, mental and emotional well-being regarding their work conduct (Amponsah-Tawiah & Dartey-Baah, 2011). Amponsah-Tawiah and Dartey-Baah contended on OHS as making it an essential discipline playing its part in any organisation's success. Conversely, Amponsah-Tawiah and Dartey-Baah continued that all the fields of psychology, medicine, technology, economics, law, et cetera, only pay attention to the OHS in critical moments. According to the World Health Organisation (1995), every worker has the right to a safe and healthy workplace that permits them to live a communally and cautiously creative life. Thus, Amponsah-Tawiah and Dartey-Baah posited that the statement mentioned above made by the WHO considers

the worker's life. Accordingly, employers must not negotiate workers' lives at any price paramount (Amponsah-Tawiah & Dartey-Baah, 2011).

According to Joshi (2011), OHS ascertains vulnerabilities and offers mitigating and adoptive procedures to control work-related dangers. Joshi added that OHS monitors all work situations to identify hazards and conditions that expose workers to risk. Joshi continued that OHS tools evaluate workers' health and take actions to decline the vulnerability of threats and dangers that can cause impairment in health. Joshi contended that OHS acts as a preventive and control measure to remove all threats during usual operating conditions. Joshi posited that OHS allows workers to prepare for emergencies and possible incidents. Joshi concluded that OHS could solidify health promotion, health education and promoting work via information circulation regarding recognized workplace health risks.

In light of the above reviewed, OHS is observed among fuel transporting companies to protect fuel truck drivers from injuries and illnesses that accompany their duties at the workplace.

**Safety Management System (SMS)**

According to Fernández-Muñiz, Montes-Peón and Vázquez-Ordás (2009), safety management systems are the cohesive mechanisms in organisations intended to control the hazards that touch workers' health and safety and ensure that organisations can conform to these mechanisms at the same time. Fernández-Muñiz et al. (2009) added that for safety management systems to be outstanding, they should be taught entirely into the organisation and be a unified system comprising strategies and procedures and policies that deliver interior uniformity and coordination. Again, Fernández-Muñiz et al.

posited that creating the safety management systems should be seen to generate consciousness, understanding, inspiration and commitment among all the organisation's employees. Additionally, Zohar (1980) commented that the safety management systems' success would depend on the commitment of the organisation's management.

However, Ming (1994) defined safety management systems as "the policies, objectives, organisation, management controls and resources which are in place to manage safety, health and environment in all parts of the business." Mitchison and Porter (1998) also contended on the definition of safety management system as "including the organisational structure, responsibilities, practices, procedures, processes and resources for determining and implementing the major-accident prevention policy." Schreiber (1991) argued that the safety management system should contain planning, organising, implementing and controlling as the fundamental functions in every organisation. These essential functions, as mentioned by Schreiber (1991) were described by Santos-Reyes and Santos-Reyes (2002) as the following;

1. Planning: that is, developing policies and the organisation's objectives and goals.
2. Organising: creating and outlining "responsibilities, accountability, roles and authorities" to realise the objectives.
3. Implementing: that is, providing the ways and means to accomplish the policy.
4. Controlling: sets to measure, evaluate and correct deviations from planned standards.

However, Bentley and Sockley (1992) described the safety management system to consist of the following:

a. To undertake a safety management system, every organisation must understand the hazards involved in its operations through a hazard management analysis. The hazard management analysis comprises the "identification, assessment, control and recovery" from the risks. In addition, the hazard management analysis enables identifying dangerous events and processes that are referred to as "safety-critical."
b. A safety management system requires a catalogue for every activity that necessitates safety. This safety management system catalogue is an amalgamation of documents. These amalgamations of forms describe and reveal how to manage safety in a firm.
c. Its commitment and support exist in a separate document referred to as the safety management system manual. This safety management system manual also contains its safety objectives and how it can realize them.

The European Process Safety Centre (EPSC) (1994) developed a safety management system guideline which comprised "policy, organisation, management practices and procedures, monitoring and auditing and management review."

However, (Ming, 1994; Bentley, Mundhenk, Jones & de Jong, 1995) argued that a safety management system comprises "establishing goals, organising and allocating resources, establishing the performance standards, implementing the plan and auditing and reviewing the system for compliance and improvement." Ming stressed that the safety management system's purpose is to assure that every individual affected by its operations, assets and

environment within and around which the organisation operates is secured. Rodricks (1993) also described a safety management system comprising four core components which are "communication, graphic displays, command and control and firefighting procedures." These, Rodricks referred to as used in dealing with "fire on passenger's vessels."

However, Robson et al. (2007) contended that safety management systems go past workers to involve both the working and the neighbouring environments. Robson et al. (2007) posited that safety management systems could avoid traumatic injuries linked to the absence of control processes.

Therefore, safety management system (SMS) ensures that fuel transporting companies put in place all the necessary planning, organisation, implementation and controlling of policies to eliminate hazards. Hazards such as unqualified fuel truck drivers, poor conditions of fuel trucks and bad conditions that bring about fuel transportation disruptions are absolutely considered and dealt with.

**Occupational Health and Safety Management System (OHSMS)**

According to Mohammadfam, Kamalinia, Momeni, Golmohammadi, Hamidi and Soltanian (2016), the execution of OHSMS can prevent and control several occupational health and safety risks. (Mearns, Whitaker & Flin, 2003; Simard & Marchand, 1994) also believed that highly advanced OHSMS relates to a declined injury rate.

(Zeng, Shi & Lou, 2007; Robson et al., 2007) also assuredly contended that OHSMS comprises "policy, planning, implementation and operation, checking, management review, responsibility, documentation, audits, records, communication and continuous improvement." After an intensive review of

various documents of OHSMS, Redinger and Levine (1998) claimed that "management commitment and resources, employee participation, occupational health and safety policy, goals and objectives, performance measures, system planning and development" were the constituents of OHSMS. Redinger and Levine continued that "OHSMS manual and procedures, training system, hazard control system, preventive and corrective action system, procurement and contracting, communication system, evaluation system, continual improvement, integration, management review" comprise OHSMS.

Robson et al. (2007) added that declining injuries and illnesses through established systems, as mentioned above, ensure operative OHSMS and several OHS experts also proclaim this. Robson et al. (2007) continued that OHSMS includes a wide array of employees' health concerns. Robson et al. (2007) argued that OHSMS's recent trends have some harmful effects. These are: the failing of foreign regulatory methods (Bennett, 2002), the growth of "blame-the-worker attitudes" (Nichols & Tucker, 2000), the movement of power to management from employees (Lund, 2004; Nichols & Tucker, 2000) and the presence of OHSMS has given birth to a false sense of safety (Gallagher, Underhill, & Rimmer, 2003).

Robson et al. (2007) again believed that the type of the intervention, characteristics of the job and characteristics of the surrounding environment ensure the accomplishment of OHSMS. However, Robson et al. (2007) posited that management focuses more on service or product quality than employees' health and safety. Quinlan and Mayhew (2000) were of a similar view that there is a high rate of doubt concerning OHSMS approaches' effectiveness due to contemporary movements in "the globalisation of business, short-term

appointment and declining organisation of workers." Conversely, Robson et al. (2007) also mentioned that OHSMS is "more proactive, better internally integrated and incorporates evaluation and continuous improvement" than outdated OHS programs.

The idea to adopt OHSMS, according to Robson et al. (2007) can either be voluntary or mandatory. Robson et al. (2007) added that the mandatory OHSMS comes from government regulation and the government enforces the OHSMS via fines, inspections and others. On the other hand, Robson et al. (2007) defined voluntary OHSMS as those carried out by private industry, employer groups, government and agencies, insurance carriers, professional organisations and standards associations and indirectly tied to governing requirements. Robson et al. (2007) added that governments do not necessitate the application of the involuntary OHSMS, but their execution attracts incentives from governments by organisations that willingly approve this OHSMS. According to (Hale & Hovden, 1998; Feyer & Williamson, 1998), OHSMS becomes ineffective if it fails to accompany constructive workplace safety culture.

***Safety culture***

The Advisory Committee on Safety of Nuclear Installations (ACSNI) in 1993 defined safety culture as "the product of individual and group values, attitudes, perceptions, competencies and patterns of behaviour that can determine the commitment to, and the style and proficiency of an organisation's health and safety management system" (Health and Safety Commission, 1993). The HSE manual in 2005 emphasized that safety culture comprises situational, psychological and behavioural elements (Health and Safety Executive, 2005).

The HSE manual expatiated that the situational feature includes management systems, regulations, procedures, policies and organisational structures associated with safety. The psychological part contains attitudes, beliefs, perceptions and values that determine behaviours and decisions concerning safety. The last element, behaviour, entails the procedures concerning safety in the workplace.

According to International Atomic Energy Agency (IAEA) (2006), a positive or constructive safety culture consists of five features. The IAEA further explained that a critical component in providing an excellent safety culture is leadership. Therefore, it is suitable for top management to show outstanding commitment to safety through leadership. The following essential component the IAEA identified was the clear communication of safety and its value. Next are the decentralization and accountability of critical groups in authority for safety in the workplace. Again, IAEA advises every worker to study safety and share ideas regarding its improvement. The workers can learn through insights and intuitions instead of learning through accidents. Workers are to change their thinking ways and act by sharing experiences and showing concern for shared problems. Lastly, the IAEA again advises employers to prioritize safety by fitting it into the company's aspects. The IAEA added, in short, that leadership of employers is the key to developing a constructive safety culture in every organisation.

The British Standards Institution (BSI) (1996) largely explains OHSMS in their worldly acclaimed Management System Standards (MSS) – ISO 45001:2018, ISO 14001:2015 and OHSAS 18001:2007, to mention just a few.

***The methodology of the Management System Standard (MSS)***

According to Soltanifar (2022), the recognized method to the MSS has the "Plan-Do-Check-Act" (PDCA) cycle, which is essential to the functioning of the OHSMS. Soltanifar added that the PDCA is critical to achieving set objectives and consistent improvement. Soltanifar explained the PDCA as follows:

*Plan*

At this stage, the organisation's OHSMS policies are being written to set goals and strategies for accomplishing them.

*Do*

During this time, the above-mentioned planned processes will be implemented.

*Check*

This phase includes monitoring OHSMS and assessing results without losing sight of all commitments, objectives and criteria, as well as reporting on them.

*Act*

This phase entails the completed steps from the previous stage to assure continuous improvement.

***Reasons for the ISO standard***

According to NSF (2020), the ISO standard ensures that;

a. The accountability of the safety needs of employees.
b. To help reduce occupational illness and injuries, a strong OHSMS is available.
c. There is a decrease in the cost of legal and insurance services.

d. There exists the establishment of positive working culture to help prevent illnesses and injuries.

e. Workers are consulted and participate in decision-making.

***ISO 45001:2018***

According to NSF (2020), "ISO 45001 is a new international standard that provides a framework for an organisation to manage risks and opportunities to help prevent work-related injury and ill health to workers." The NSF revealed that the intention of ISO 45001 is to assist businesses of any size or industry in developing procedures to prevent injury and illness. NSF added that ISO 45001 requirements are designed and integrated with business management and processes.

Many have discussed the ISO 45001 as a golden benchmark and was concluded in March 2018 to improve safety and health risk (Foulke Jr., 2019). Foulke Jr. added that this new standard offers a framework capable of meaningfully enhancing organisations' safety and health programs, reducing workplace damages and illnesses, advancing worker output and work value and intensifying proceeds.

Foulke Jr. continued that the ISO 45001 intensifies the importance of leadership participation and enforces administration teams with making, enabling, preserving, appraising and encouraging safety risk management systems. Foulke Jr. furthered that this new standard strongly advocates employees' consultation and participation in decision-making and assessment processes. Furthermore, Foulke Jr. contended that the ISO 45001 considers the safety risks at the workplace. Still, the ISO 45001 does require management to address the impacts safety risks have on other interested parties such as

suppliers, vendors, contractors, passers-by and neighbours (Foulke Jr., 2019). Finally, Foulke Jr. revealed a great side of ISO 45001 about its compatibility with the various standards: ISO 9001 and ISO 14001. According to Foulke Jr., the BSI built this new standard on the same framework – Annex SL – of the earlier standards. Similarly, it adds value to a company's sustainability by influencing employee performance, inspiring innovation, involving all stakeholders and improving procedures constantly.

*The Annex SL* (Darabont, Antonov, & Bejinariu, 2017; Soltanifar, 2022; Campailla, Martini, Minini, & Sartor, 2019).

The new MSS – ISO 45001 – structure imitates the Annex SL, which describes the ISO MSS's expectations: the presentation of this standard and the inscription of alignment and chronology with each other. The Annex SL aims to provide one framework and terminology for every management system to help businesses line up and integrate their management systems. This framework also teaches the MSS "risk-based thinking" and the concept of the "context of the organisation." "Risk-based thinking" is based on the idea that organisations develop and implement their management systems by integrating them into their planned processes. This framework describes the ideologies fundamental to each clause and deep explanations concerning the clause's "purpose, the typical data input, the process to implement and the expected results." It also stresses leadership and the participation and consultation of every party with a lot of interest in management systems (Darabont, Antonov, & Bejinariu, 2017).

*Context of the organisation (Clause 4)*

The fourth clause necessitates the organisation to appreciate its context by revealing the internal and external matters with positive or negative influences on the organisation's capability to realise its proposed results of the OHSMS. The context (clause 4.1) can refer to the organisation's general working environment and internal or external concerns influencing planned outcomes. External concerns are those that are associated with the "socio-political and environmental conditions of workplace locations, the legal framework, the relationships with the interested parties and external contractors, the conditions determined by the reference market and the product group."

The internal matters are those that are associated with the "organisation's size, nature and activities, its governance and policies, values and culture, its assets in terms of material resources and human capital." Therefore, this clause's issues, concerns and matters are indispensable to developing OHSMS suitable for the organisation's size and complexity.

Clause 4 also considers the needs and expectations of interested parties (sub-clause 4.2). This portion of the clause expects the organisation to find other internal or external parties aside from employees who may affect or be affected by the OHSMS. This sub-clause determines whether their requirements and expectations will be pertinent to the management system during identifying the interested parties and should be well-thought-out when establishing the OHSMS. This element of this clause mandates the organisation to find which needs and expectations of interested parties are required by law and decide whether to comply. These interested parties could be "customers, suppliers, regulating authorities, contractors and other external providers, shareholders,

visitors, local communities and media." Next is the scope of the OHSMS after the context and the needs and expectations of interested parties.

The scope of the OHSMS (sub-clause 4.3) is also a crucial element of the organisation's context (clause 4). Considering the pertinent matters of the context, the relevant issues of interested parties and the organisation's activities and services that can affect the OHS's performance shall conclude the range of the OHSMS. In an attempt to work within the scope of the OHSMS, the organisation's competence to control the workplace and the work-related activities become affected. As a result, the content definition of OHSMS is to include any locations outside of the organisation's headquarters where work-related activities are carried out. Embedded within this definition of the workplace and the scope of the OHSMS are all internally carried out activities, construction sites, transportation routes, permanently or occasionally carried out actions at customers' locations like services, maintenance and assembly. As soon as the scope is definite, the establishment of OHSMS (clause 4) becomes finite.

*Leadership (Clause 5)*

After establishing the OHSMS, the integration of OHSMS into the business processes follows (sub-clause 5.1). This integration warrants considering safety objectives and requirements to connect interested parties critical to the management system's success rate. In addition, the ISO 45001 stresses the relevance of top management leadership and commitment, evident through an apparent succession of actions.

The top management's definition and approval of the organisation's health and safety policy (clause 5.2) is the first step to demonstrating and

providing stability to the management system. The OHS policy explains its overall direction, considering its mission, vision and values to describe the health and safety objectives. The appropriateness of those mentioned above should involve the organisation's features, risks, opportunities and context without neglecting the commitment to required health and safety standards, continuous improvement, stoppage of damage and ill-health consultation and employee participation.

Sub-clause 5.3 of clause five talks about organisational roles, responsibilities and authorities of leadership. Clause 5.3 challenges top management to delegate and communicate effectively to the staff and everybody under their control and interested parties within its OHS policy.

Subsequently, the standard enforces the effectiveness of OHSMS through the consultation and participation of interested parties (clause 5.4). This clause advocates that top management involve workers in the "development, planning, implementation, performance evaluation and improvement actions" of the OHSMS. This sub-element of leadership extends to non-managerial employees with diverse matters in the organisation.

*Planning (Clause 6)*

Once the foundations of the clauses above have been laid, the planning stage commences. This phase comprises two broad areas: plans to report risks and opportunities (clause 6.1) and plans to achieve OHS objectives (clause 6.2). The stage that concerns the report on risks and opportunities requires "hazard identification and assessment of risks and opportunities (clause 6.1.2), determination of legal or compliance obligations (clause 6.1.3) and planning actions (clause 6.1.4)" essential in addressing the risks and opportunities. In the

quest to achieve plans for OHS objectives, the OHS objectives are to be established (clause 6.2.1) first and subsequently enact appropriate techniques to achieve these objectives (clause 6.2.2).

*Support (Clause 7)*

This clause sets the new stage after the achievement of planning. The support phase comprises resources management (clause 7.1). This sub-clause speaks about the resources needed to realize the specified objectives and continuous improvement must be available. The support phase also constitutes competence (clause 7.2). This sub-clause ensures that workers or employees tasked with the responsibility of the OHSMS are experienced, trained and educated enough to be proficient and confident. The support phase also contains awareness (clause 7.3). This sub-clause ensures that workers must know the OHS policy and its constituents. Lastly, the support phase includes communication (clause 7.4) and documented information (clause 7.5). Communication (clause 7.4) is sub-divided to comprise internal communication (clause 7.4.2) and external communication (clause 7.4.3), which are provided to serve as documented material within the OHSMS. Established information (clause 7.5) is sub-divided by the standard to comprise: creating and updating of OHSMS information – (clause 7.5.2) – for suitable "identification, description and format" for easy understanding and the control of information documented – (clause 7.5.3) – on OHSMS should be accessible wherever and whenever desired, practically kept from destruction or upholding integrity and uniqueness and that the methods for delivery, preservation, accessing, recovery, protection and storing are sufficiently ensured.

*Operation (Clause 8)*

A critical role of "operational control and planning" (clause 8.1) requires eliminating hazards and reducing OHS risks. Clause 8.1 can be accomplished over order control, eradicating the menace to PPE usage. The operational management and planning depend on the "size, nature, compliance obligations and OHS hazards of an organisation" and look forward to evaluating and controlling OHS risks. Another critical element of clause 8 is "emergency preparedness and response" (clause 8.2), ensuring OHS risk mitigation. This sub-clause establishes all actions necessary for the alleviation of incidents. Clause 8.2 takes into consideration all varying forms of OHS incidents.

*Performance evaluation (Clause 9)*

With this clause, the organisation has to monitor, measure, analyse and evaluate (clause 9.1) OHS progress without neglecting substantial hazards, legal requirements and operational controls. Clause 9.1 also ensures that the moments to monitor and measure are associated with the needs of the OHSMS in gathering data and results such that the results are precise, reliable and replicable. Top management must be informed of the developments to call for action based on the output. A sub-clause, evaluation compliance (clause 9.1.2) of clause 9.1, recognizes that complying with legal demands is an essential requirement though it may differ from one organisation to another organisation. Another necessary clause of performance evaluation (clause 9) is an internal audit (clause 9.2). Clause 9.2 sets that internal audits and auditors are supposed to be autonomous to prevent conflict of interests. This clause (clause 9.2) also advocates the idea of taking corrective actions in the advent of non-conformities in the auditing process.

Additionally, the internal audit program (clause 9.2.2) is a critical sub-clause to the internal audit (clause 9.2). The internal audit program sets the rules that could subscribe to the internal audit's effectiveness. The frequency on which an organisation performs its internal audit depends on its size, operable sector, legal requirement and the risk associated with employees' health and safety. With clause 9.2.2 accomplished, management review (clause 9.3) then sets in. Management does not conduct reviews all at once but in a series of meetings by tackling topics individually – top management review complaints issued by interested parties and then makes room for improvement opportunities. Before the OHSMS can function, the management review must work precisely and meticulously. The OHSMS can take a definite requirement when information from management review (clause 9.3) is documented and recorded.

*Improvement (Clause 10)*

The basis of improvement is dependent on the output of "management reviews, internal audits and compliance and performance evaluations." Management could take corrective actions, innovation, re-organisation as examples of improvement. Clause 10.2, which deals with "non-conformity and corrective action," addresses the occurrence of problems through correctness and control. Clause 10.3, a sub-clause of improvement (clause 10), talks about "continual improvement." The accomplishment of this sub-clause becomes possible when the emphasis is on all the clauses mentioned above.

Figure 2 below is an illustrated structure of the Occupational Health and Safety Management System (OHSMS): ISO 45001. This figure depicts the involvement of fuel truck drivers' representative together with management in

the formulation of fuel transporting policies (P) in the organisation. These plans are formulated taken into consideration the context of the organisation, the internal and external environments, the needs and expectations of interested parties and the scope of OHSMS. After the formulation of these policies, these fuel truck drivers' representative and management of the organisation together provide support and operate (D) to implement the fuel transporting policies. Among other things, the implementation allows the selecting of fuel trucks that are in perfect condition to operate due the risk intensive nature of the oil and gas industry. Following this implementation, management together with the fuel truck drivers' representative evaluate performance (C) comparing expected performance to actual performance. This comparison is to ensure whether the fuel transportation disruption causing conditions led to an accident or not. The resultant outcome from the comparison leads to improvement (A) where deviations from the outcome are corrected and featured into the new plan.

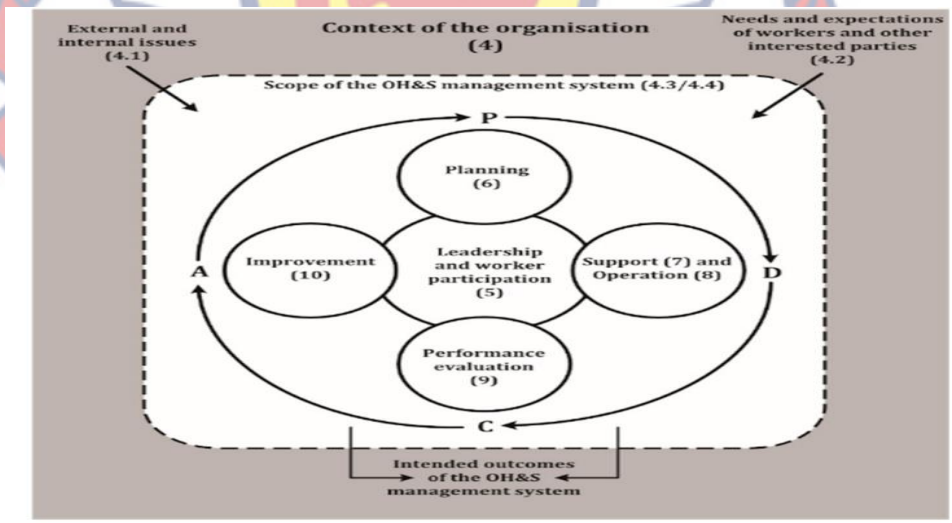


*Figure 2*: Occupational Health and Safety Management System (OHSMS) - ISO 45001

Source: Morgado, Silva and Fonseca (2019).

## Empirical Review

This section reviews studies during which various researchers conducted multiple studies on occupational health and safety management systems (OHSMSs) and fuel transportation.

### Health and Safety in Organisations

Liu, Nkrumah, Akoto, Gyabeng and Nkrumah (2020) studied Occupational Health and Safety Management Frameworks (OHSMF) and injuries and accidents using three oil and gas data sources companies in Ghana. Liu et al. (2020) hypothesized that safety knowledge significantly affected OHSMF and workplace accidents and injuries. Liu et al. had 699 respondents for the distributed questionnaires in a survey strategy. Liu et al.'s research design was quantitative and their data were analysed using multiple regression analysis and bootstrapping methods. After the investigation, Liu et al. found that workplace accidents and occupational injuries were rising. Thus, Liu et al. concluded that the relationship between OHSMF and workplace accidents and occupational injuries was strongly negative and significant. This implies that OHSMF reduced workplace accidents and occupational injuries in those three oil and gas companies through the Domino Theory and/or the Swiss Cheese Model.

However, Amponsah-Tawiah and Dartey-Baah (2011) focused on general occupational health and safety (OHS) issues in Ghana. Amponsah-Tawiah and Dartey-Baah identified the lack of a comprehensive OHS policy, insufficient information, insufficient number of competent OHS practitioners and a general lack of structure and money as the key obstacles to implementing OHS services. Amponsah-Tawiah and Dartey-Baah concluded that the absence

of OHS and workers' reduced capacity could cause an economic loss of about 10% to 20% of a country's Gross National Product (GNP). In the same vein, the lack of a comprehensive OHS policy, insufficient information, insufficient number of competent OHS practitioners and a general lack of structure and money have the propensity to lead to dire consequences through the Swiss Cheese Model.

However, a study by Fernández-Muñiz, Montes-Peón and Vázquez-Ordás (2009) that looked at the association of occupational safety management and the performance of firms aimed at identifying positive practices in safety management and analysing the effect these practices had on organisational performance. In their study, Fernández-Muñiz et al. (2009) hypothesised the following;

a. The safety management system had a positive relationship with safety performance.
b. The safety management system had a positive relationship with competitive performance.
c. The safety management system has a positive relationship with economic-financial performance.

Like Liu, Nkrumah, Akoto, Gyabeng and Nkrumah's (2020) study, Fernández-Muñiz et al. did quantitative research by acquiring data from about 3,820 from both national and international Spanish firms from a population of 62,146 firms. Fernández-Muñiz et al.'s data obtained through questionnaires were analysed using the exploratory analyses with varimax rotation and confirmatory factor analyses using structural equation modelling, employing the statistics programs SPSS/PC version 14. After their investigation, Fernández-Muñiz et al. found

that safety management system positively correlated with safety performance, competitive performance and economic-financial performance. Furthermore, Fernández-Muñiz et al. resulted that implementing a safety management system had several benefits, far from economic burdens. The results from this study indicates that errors emanating from people through the Human Factor Model, Swiss Cheese Model and/or Domino Theory were prevented due to the proper implementation of safety management system.

However, Mohammadfam, Kamalinia, Momeni, Golmohammadi, Hamidi and Soltanian, (2016) conducted a study that looked at the effectiveness of OHSMS assessed and promoted by an established, cohesive decision-making method in Iran. Mohammadfam et al. (2016) aimed at presenting the cohesive decision-making method by integrating two techniques – Analytical Network Process (ANP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) – to evaluate and advance the effectiveness of the OHSAS 18001 standard. In mixed-methods research, Mohammadfam et al. (2016) interviewed 32 OHS experts as the population, but they had 26 OHS experts as the sample size. Mohammadfam et al.'s data collection methods for their study were questionnaires and document review. Mohammadfam et al. found out that training, risk assessment, definite responsibility, communication, allocation of financial resources, workers' participation, management commitment and dissemination of OHS results and activities were the most influential factors to be considered for an adequate OHSAS 18001 standard. Based on the findings of Mohammadfam et al.'s study, an adequate OHSAS 18001 standard will prevent workplace accidents likely to occur through the Domino Theory, the Human Factor Theory and/or the Swiss Cheese Model.

However, Marhavilas, Koulouriotis, Nikolaou and Tsotoulidou (2018) looked at OHSMSs standards as a global benchmark for sustainability to employ OHMS application as reinforcements. First, Marhavilas et al. (2018) used questionnaires to obtain quantitative and qualitative data through document review in a mixed-methods research design. Then, Marhavilas et al. analysed the quantitative data through inferential statistics and qualitative data through content analysis. According to Marhavilas et al., an effective S_OHSMS that can benefit any organisation must use organisational resources effectively, enhance financial performance, improve risk management and improve constant transport and enhanced product services. Marhavilas et al. concluded that industries and constructions use the highest percentage of OHSMS. These industries and constructions use the highest percentage of OHSMS to limit the occurrence of accidents through the domino effect, the Human Factor Theory and/or Swiss Cheese Model.

Horbah, Pathirage and Kulatunga (2017) also assessed the influence of safety climate on the risks of major accidents in Ghana's upstream oil and gas industry. Based on quantitative research, Horbah et al. (2017) used a population of 250 employees from five different oil and gas companies in the upstream sector in Ghana. In addition, Horbah et al. sampled 212 employees from five independent oil and gas companies in Ghana's upstream sector. Horbah et al. collected their data through questionnaires and analysed using the multiple regression analysis. Horbah et al.'s study revealed that safety priority and supportive environment had a high projecting effect on the principal risks of accidents. Horbah et al. added that supervising safety, changing management, equipment maintenance and management commitment also impact key risks for

accidents. Meanwhile, the study's findings of Horbah et al.'s research indicated an appreciated direction for investigators to determine how overall safety can be improved in the work environment. If principal risks are not prevented, they can cause serious accidents through the domino effect or the Swiss cheese incident.

Similarly, Çalış and Büyükakıncı (2019) investigated the applications and practices of OHSMS in Turkey and other countries. Çalış and Büyükakıncı's study exposed the benefits OHSMS provided to workers, companies and governments. Çalış and Büyükakıncı's analysis was based on the review of detailed literature on OHSMS from diverse countries such as Poland, Australia, Norway and Sweden. Çalış and Büyükakıncı's results on the thorough study of the literature showed that the OHSMS had successful outcomes and accomplished substantial cost reductions in all the countries the OHSMS was applied and practised. The ramifications of the findings are that the Swiss Cheese Model and the Domino Theory were avoided.

However, Nordlöf, Wiitavaara, Högberg and Westerling (2017) investigated the different factors that impact OHSM practices in various manufacturing companies in Sweden county. Nordlöf et al. (2017) noted these factors: company size, safety culture and safety performance to affect the OHSM practices. Based on a quantitative study, Nordlöf et al. sampled 238 employees from a population of 476 employees in various manufacturing companies in Sweden. Nordlöf et al. collected data using questionnaires and these data were analysed using regression analysis. After the investigation, Nordlöf et al. showed that safety culture, company size and creditworthiness had better associations with OHSM practices in all manufacturing companies in

the Swedish county with ten employees and over. The results are implications that the Swiss Cheese Model and the Domino Theory were prevented from happening.

**Conditions of fuel Trucks and Conditions that Influence Fuel Transportation Disruption**

However, Martinez (2013) conducted a similar study on an Liquified Petroleum Gas (LNG) road tanker explosion. Martinez assessed and measured the data obtained on an LNG tanker explosion and this event conformed to similar events' theoretical risk analysis. After the investigation, Martinez recommended using virtual pipelines in transporting LNG to prevent future interruptions in fuel transportation by road. Martinez added how unsafe it is to transport LNG in fuel tankers constructed in a single wall with polyurethane insulation and aluminium cladding. Martinez again positioned that the interruption generated was severe to cause an explosion, but firefighters and the police evacuated the civilians on time to save their lives. Furthermore, Martinez added that if LNG road tankers overheat, an accident in the transportation process could occur at any time. The findings of this study indicates that if a critical scrutiny was be done on the fuel truck through the Systems Theory Model, the explosion would not have occurred.

Similarly, Planas-Cuchi, Gasulla, Ventosa and Casal's (2004) study focused on the explosion of a fuel tanker full of LNG. Planas-Cuchi et al. (2004) exposed the road tanker's accident sequence and subsequent explosion and reported that the LNG tanker driver lost control due to speeding and overturned after a series of analyses. Planas-Cuchi et al. again said that flames immediately gutted between the cabin and the LNG truck trailer. Based on this study's

finding, a Systems Theory Model was needed to assess the fuel truck before work and loading.

However, Bariha, Mishra and Srivastava (2016) conducted a study concerning the investigation of the accident and explosion of LNG transportation reported India's accidents' analysis and simulations. In the data analysis by using the ALOHA (Area Locations of Hazardous Atmospheres) and the PHAST (Process Hazard Analysis Software Tool) software, Bariha et al. (2016) discovered that the LNG tanker hit the road divider and overturned. Bariha et al. added that the accident got a bottom pipe on the LNG tanker cracked, which caused leakage on the LNG tanker. Bariha et al. further reported that the leakage formed a large vapour cloud that ignited, created a fireball and subsequently caused an explosion. This accident caused several fatalities and injuries and the destruction of nature like trees and many properties such as shops, vehicles, houses and others in close range (Bariha, Mishra & Srivastava, 2016). Based on the results of this study, the Systems Theory Model was required to assess the environment before work began.

Aderibigbe (2017), on the other hand, did research into a jet fuel tanker accident in Nigeria. Aderibigbe revealed that a primary source of fuel transportation disruption by road is driving under the influence of alcohol and existing operational issues after doing a root cause analysis and using the fishbone diagram. The findings of Aderibigbe study require the Systems Theory Model to check fuel truck drivers before executing tasks.

Al Chukwuma and Atelhe (2015) conducted a threat impact analysis on fuel transportation and humans' safety in Nigeria. Al Chukwuma and Atelhe research revealed the implications of fuel tanker explosions on Nigeria's

national security. Al Chukwuma and Atelhe's findings underscored the dangers regarding interruptions in fuel transportation. Through a content analysis, this study also showed that the slightest interruption in fuel transportation has dire consequences to the point of threatening Nigeria's road safety and human security (Al Chukwuma & Atelhe, 2015). Again, Al Chukwuma and Atelhe recommended that rail transportation be used as the alternative for fuel transportation to mitigate the dire repercussions of interruptions in the transportation cycle. Based on Al Chukwuma and Atelhe's findings, the Systems Theory Model is required for a safer movement of fuel in Nigeria.

**Chapter Summary**

This chapter has presented the viewpoints fundamental to this research's focus and has served as the foundation for this study's development. This chapter builds on three central tenets: the theoretical framework, the conceptual review and the empirical review. Firstly, the theoretical framework sought to develop the leading theory for the study: the System Theory or approach. Next, the conceptual framework also sought to develop the study's main concepts: safety, safety management, management system, safety management system, occupational health, occupational health and safety and occupational health and safety management system. The management system standard (MSS) methodology, reasons for the ISO standard and ISO 45001:2018 are all part of the occupational health and safety management system (OHSMS). The final section discussed was the empirical review.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## Introduction

The methodological approach to primary data collection, analysis and presentation is discussed in this section. According to Leedy, Ormrod and Johnson (2014), research methodology is the researcher's overall strategy to carry out a research endeavour. Therefore, the chapter addresses the most crucial thematic areas covering the research design, study area, population, sample and sampling procedure and data collection instruments. Also discussed are the data collection procedure, data processing and analysis, validity and reliability, pre-testing and ethical consideration.

## Research Design

A set of principles and instructions known as a research design must be followed in order to investigate the research problem Leedy, Ormrod and Johnson (2014). Again, research design is the overarching strategy for linking conceptual research concerns to relevant (and attainable) empirical research (Zikmund, 2000). Additionally, research design according to Saunders, Lewis and Thornhill (2009) comprises the type of study, the research methods to employed for the study, the research strategies to be utilised for the study and the time horizon for the research.

First, the research used explanatory and descriptive studies to explain the connection between and described the variables under investigation. This is established by describing the relationship between the various variables which are the driver, the vehicle and the environment. Explanatory and descriptive studies were chosen because the research sought to describe the relationship

between the fuel truck driver, the vehicle used by the driver and the environment and other conditions that influence fuel transportation mishaps.

Second, the research methods used for the study was the quantitative methods. Quantitative methods because responses to the questionnaires from respondents were represented as numerical data. Moreover, the study utilised the survey research strategy because of the use of questionnaires to obtain large data. Again, according to Saunders, Lewis and Thornhill (2009), the survey approach enables the collection of quantitative data that can then be quantitatively analysed using descriptive and inferential statistics.

Finally, the study was cross-sectional considering the period for conducting the study. Again, Saunders, Lewis and Thornhill (2009) contended that the survey strategy is commonly used in cross-sectional investigations. Additionally, cross-sectional studies seek to describe the occurrence of a phenomenon as proclaimed by Saunders et al. (2009).

**Research Philosophy**

This research employs a positivist philosophy, allowing the researcher to comprehend the topic within the context of descriptive and casual frameworks (Yilmaz, 2013; Hays & Wood, 2011; Aaker, Kumar, George & Day, 2001). According to proponents of the positivist philosophy, this methodology entails conducting research into an observable social observation and drawing conclusions and generalizations (Cooper & Schindler, 2008). Thus, the positivist philosophy specifically entails data gathering, analysis of collected data and presentation of findings that are quantitatively reported. This philosophy is used since the study entails gathering information on fuel truck drivers, fuel truck conditions and conditions that may lead to a fuel

transportation accident on the Kumasi-Accra highway (N6). These data are further analysed to describe the relationship between the aforementioned variables.

**Study Area**

The study was conducted on the Kumasi-Accra highway (N6). The N6 is part of Ghana's national highways that is 272 km long and starts at the Nsawam road junction off the N1 (Elubo – Aflao highway) in Accra and travels through the towns of Nsawam, Nkawkaw and Ejisu before coming to an end in Kumasi where it connects with the N4 (Accra – Koforidua highway). Again, the N6 connects Accra to Kumasi as an alternative to the N4 and passes through Ghana's Greater Accra, Eastern and Ashanti regions. This study area was chosen because Ghana's most populous and second-most populous cities are Accra and Kumasi (Amuasi et al., 2016). Therefore, as more economic activities occur in Ghana's most populated and second-most populous cities, the demand for fuel to power vehicles, run factories and cook in individual homes will rise.

**Target Population**

The population is the target group about which the researcher is interested in learning more and forming conclusions, according to Leedy, Ormrod and Johnson (2014). Additionally, it has been argued that the population's participants must share at least one characteristic that is important to the researcher (Asiamah, Mensah & Oteng-Abayie, 2017). The population for the study comprised of all 200 fuel truck drivers at JK Horgle Company Limited. The study considered all 200 fuel truck drivers because every fuel truck driver has an equal chance to ply the N6.

**Sample and Sampling Procedure**

Malhotra and Birks (2007) define sampling as the process of choosing a representative few or unit from a broader group or population that is then utilized as a basis for estimating specific traits or aspects about the group or population. Simple random technique was employed for the study's sampling because of the equal chance each fuel truck drivers has in order to ply the N6. All the fuel truck drivers at JK Horgle Company were used for the study. Out of 200 fuel truck drivers, 140 were chosen as the study's sample size. This sample size determination was informed by Krejcie and Morgan's (1970) sample size determination table.

The respondents were chosen using a simple random sampling technique. Simple random sampling is used because it gives all participants in the study an equal chance of being chosen to respond to the research questions and because the population of the study shares many of the same desirable qualities.

**Data Collection Instruments**

Data were gathered using a questionnaire that was created depending on the study's specific research objectives. This instrument was employed as the primary method for data collection since it provides respondents with a higher level of assurance regarding confidentiality and anonymity (Sarantakos, 2005). It is highly efficient in obtaining factual data about behaviours and circumstances that respondents are assumed to be aware of. According to Ogah (2013), it is also employed to elicit information about subjects' attitudes, beliefs, feelings and behaviours. Despite this, the questionnaire has some flaws. The use of questionnaires prohibits question elicitation, prompting and clarification.

Additionally, while employing a questionnaire, the respondent's identity and the circumstances of the questionnaire's completion are unknown. As a result, the researchers are unsure if the appropriate person provided the answers. Last but not least, due to a lack of oversight, partial response is very likely (Sarantakos, 2005). There were three primary sections to the questionnaire. The socio-demographic characteristics were the main topic of section one. The conditions of fuel trucks were covered in section two. Questions about the conditions that encourage fuel truck interruptions were asked in the questionnaire's final part. There was a total of thirty (30) questions on the questionnaire (See Appendix A). The pre-testing of the questionnaire took place at Ghana Oil Company (Goil) and Benab Oil, both of which are located opposite the Cape Coast Sports Stadium in the Cape Coast Metropolis. This was carried out to assess the instrument's reliability.

**Data Collection Procedures**

First, preparatory contacts were conducted with the respondents to ensure a simple data gathering procedure. The data was gathered at various intervals to account for the respondents' various free times in order to guarantee that all respondents took part in the study. A portion of the data in this respect was gathered in the morning and the remainder was gathered in the afternoon. Additionally, a window of two weeks (from July 14 to July 30, 2021) was designated for the data gathering exercise in order to guarantee the highest possible timely response rate. In order to help respondents who had problems grasping some of the items on the questionnaire, insights into what the study aimed to accomplish were provided to the respondents. There were 140 questionnaires distributed to the respondents in total. 132 questionnaires were

obtained by the researcher representing (93%) return rate. A return rate of 70% or above are considered to be satisfactory and acceptable, according to Dillman (2000).

**Data Processing and Analysis**

Adèr (2008) argued that data analysis is the act of editing, cleaning, manipulating and modelling data to emphasise helpful information, ideas, conclusions and decision-making support. In view of this, the Statistical Package for Social Science (SPSS version 26.0) was used to code and edit the questionnaire responses. This statistical software is highly recommended for social science research (Zickmund, 2000). The completed questionnaires were coded as Q1, Q2, Q3 to the last Q132. For the quantitative data, descriptive statistics were used, which, according to Conner and Johnson (2017), offered an analysis that described and summarised results for easy understanding. Descriptive statistical methods, such as frequency counts and percentages, would be used to analyse and interpret the data (Leedy, Ormrod & Johnson, 2014). The findings were presented in Tables in a chronological manner in Chapter 4 to reflect the sequence of the specific objectives taken into account in the study.

**Validity and Reliability**

When assessing a particular instrument, validity and reliability are two important factors to take into account (Mutepfa & Tapera, 2019). When an instrument accurately measures any required variable, it is valid and the degree to which grades are unaffected by estimating errors is referred to as reliability (Ghazali, 2016). Again, consistency of the instrument is a concern for reliability and if it can be relied upon to provide an accurate and consistent measurement

of an unchanging value, an instrument is said to have high reliability (Bless & Higson-Smith, 2000). In addition to placing a strong emphasis on each individual construct, the internal consistency technique was employed to assess the scale's reliability. For the purpose of measuring internal consistency, a Cronbach's Alpha value was applied. Typically, outcomes with a cut off of 0.7 or higher are regarded as better (Pallant, 2005). The reliability test results for the variables shown in Table 1 demonstrates that all the constructs are very reliable in that the results are all greater than the minimum requirement established by Pallant. The evidence for this claim is as follows: background of the fuel truck driver (Cronbach's Alpha = 0.872, Items 6), conditions of fuel trucks (Cronbach's Alpha = 0.857, Items 11), conditions that facilitates fuel transportation accidents (Cronbach's Alpha = 0.864, Items 13) and the overall scale (Cronbach's Alpha = 0.868, Items 30). For each of the study's individual constructs, the reliability score is summarized in Table 1.

**Table 1: Reliability Statistics**

| Constructs | Cronbach's Alpha | No. Items |
|---|---|---|
| Overall Scale | 0.868 | 30 |
| Background of Driver | 0.872 | 6 |
| Conditions of Fuel Truck | 0.857 | 11 |
| Conditions Facilitating Fuel Truck Mishap | 0.864 | 13 |

Source: Field survey (2021)

An instrument's validity is determined by how well it captures the specific concept that it is intended to measure (Saunders, Lewis, & Thornhill, 2009). It displays how well the reality under study is captured during data gathering and processing for the research (Mohajan, 2017). According to Saunders et al. (2007), an instrument must also be consistently repeatable in

order to be reliable before it can be considered valid. Once this has been accomplished, the instrument may then be carefully examined to determine whether it is what it claims to be. The researcher reviewed pertinent literature to assess the validity of the questionnaires and those reviews supported the instrument's design. The scales contained certain items that were scientifically validated. Before being given to the respondents, the prepared questionnaire was also given to the project supervisor for review, modification and approval.

**Pre-testing**

Pre-testing was done to check the reliability of the study tool and to improve the questions so that respondents would have no trouble answering them. In order to guarantee that instructions, questions and scale items are clear and that potential respondents would be able to grasp the questions and react accurately, Pallant (2007) argued that a pre-test is necessary prior to a primary survey. A further benefit is that it aids the researcher in identifying and removing any question that would offend possible respondents. The pre-test was conducted in May 2021 with 15 participants from two fuel retail outlets in the Cape Coast Metropolis. Benab Oil Company and Ghana Oil Company (Goil) were the two retail fuel outlets that were chosen. Due to their homogenous qualities (transporting fuel) with the company employed for the study, these fuel retail outlets were deemed appropriate. Questions (25, 26, 27, 28, 29 and 30) were rephrased following the pilot testing.

**Ethical Consideration**

The conduct of a study of this kind must take access and ethics into account. Having access to reliable and pertinent sources is necessary for gathering data from respondents. The researcher identified himself to the

manager of the chosen company as a postgraduate student from the University of Cape Coast who is conducting a study on "Occupational Health and Safety Management Systems (OHSMSs) for Fuel Transportation in Ghana" in order to gain access to the fuel truck drivers of the company. Respondents were guaranteed that the study was entirely academic and partially satisfied the requirements for the award of a Master of Philosophy in Oil and Gas Resource Management.

In keeping with proper protocol, the respondents were also made aware of their part in giving valuable information as well as the intended use of the information. The anonymity and confidentiality of their responses were further assured and they were also made aware of the survey's voluntary nature. No personal information was requested in the questionnaire's content in order to uphold confidentiality, anonymity and privacy. In a similar vein, no comments were made in the final report regarding specific responses. In order to present the study's findings objectively, they were neutrally treated.

**Chapter Summary**

The methods and procedures used in this study were described in detail and justified in this chapter. The chapter provided an overview of the study's design and philosophy. It included descriptions of the survey's population, the sample and sampling procedure, the method of data collection, the data collection procedure and the statistical techniques used to analyse the data. The research tool's validity and reliability were evaluated. Prior to completing the chapter with a description of the ethical concerns applicable to the investigation, special attention was given to the Statistical Package for Social Science (SPSS

version 26.0) as the major analytical tool for attaining the study's principal objective.

# CHAPTER FOUR

# RESULTS AND DISCUSSION

## Introduction

The acquired data were analysed and discussed in this chapter. The research questions that guided the study were the basis for the analysis. In addition, the researcher assessed concepts expressed by experts in the literature reviewed in Chapter Two to investigate the issues that arose from the data and to compare and contrast thoughts. Furthermore, the researcher used specific objectives to accomplish the study's primary goal, which was "to assess the efficiency for the adoption and implementation of OHSMSs for fuel transportation in the downstream oil and gas industry along the Kumasi-Accra route (N6)." This chapter, therefore, presents the findings and discussions that reflect the core study objectives as indicated in Chapter one and the methods used.

The various sections of this chapter address the specific research questions relating to the following:

1. What is the background of fuel truck drivers who ply the Kumasi-Accra highway (N6)?
2. What are the conditions under which fuel trucks ply the Kumasi-Accra highway (N6)?
3. What conditions influence fuel transportation disruptions on the Kumasi-Accra highway (N6)?

**Background of fuel truck drivers who ply the Kumasi-Accra Highway (N6)**

According to research question one, the respondents were given six primary aspects, which examined the background of fuel truck drivers who ply the Kumasi-Accra highway (N6). The researcher chose these six components based on some of JK Horgle Company Limited's recruitment criteria from the company's website. Subsequently, the researcher asked the respondents the following:

*"What is the background of fuel truck drivers who ply the Kumasi-Accra Highway (N6)?"*

For this question, descriptive statistics like frequency and percentage were used to measure the findings. For this analysis, these measures were suitable. Table 2 displayed the findings.

**Table 2: Background of fuel truck drivers who ply the Kumasi-Accra Highway (N6)**

| Variable | Options | Frequency | Percentage |
|---|---|---|---|
| Gender | Male | 102 | 77.3 |
| | Female | 30 | 22.7 |
| Age | Below 25 | 0 | - |
| | 26 – 30 | 4 | 3.0 |
| | 31 – 35 | 29 | 22.0 |
| | 36 – 40 | 39 | 29.6 |
| | 41 – 45 | 32 | 24.2 |
| | 46 – 50 | 18 | 13.6 |
| | 51 – 55 | 10 | 7.6 |
| Working experience | 1 – 3 | 75 | 56.8 |
| | 4 – 6 | 36 | 27.3 |
| | 7 – 10 | 21 | 15.9 |
| Driver's Licence Grade | B | 10 | 7.6 |
| | F | 122 | 92.4 |
| Drivers not involved in FTAs | | 132 | 100 |
| Edu. Lev. of Fuel Trk. Driv. | BECE | 71 | 53.5 |
| | SSCE/WASSCE | 41 | 31.2 |
| | Bachelor's Degree | 20 | 15.3 |

Source: Field survey (2021)

The findings on gender at JK Horgle Company Limited show that 102 of the 132 respondents (77.3%) were males, whereas 30 (22.7%) were females. The domination of males in the company is an indication of the nature of the haulage of fuel which requires boldness, daringness and both intrinsic and extrinsic motivation. Although the majority of the employees are men, the management of the company does not violate the company's gender equality policy in the company's constitution, which gives equal opportunities to qualified females. In essence, the fact that there are more men than women reflect the nature of the work, which favours men because it requires great

mental and physical strength. As a result, the outcome represents the gender profile of employees at JK Horgle Company Limited.

The respondents' age distributions revealed that the majority of respondents (n=39) representing 29.6 percent were between the ages 36 – 40 years. This was followed by those who fall between the ages 41 – 45 years (24.2%). In a similar vein, the researcher found out that 22.0% and 13.6% were between the ages 31 – 35 years and 46 – 50 years respectively. However, it was discovered that a few fuel truck drivers were between the ages 26 – 30 years (3.0%) and 51 – 55 years (7.6%) with no fuel truck driver falling below 25 years (0%). Since the majority of respondents said they were between the ages of 31 – 45 years, JK Horgle Company Limited's workforce structure is characterized by relatively active workers. As a result, this is equivalent to 76% of survey respondents. The dominance of the active workers means that fuel truck drivers are able to perform their job roles and responsibilities to expectation which have a resultant effect in preventing road mishaps.

Out of 132 respondents, 75 (56.8%) have working experience between 1 – 3 years, which represents the majority of the respondents. The next group of fuel truck drivers, with a frequency of 36 (27.3%), have 4 to 6 years working experience. Again, the remaining 21 fuel truck drivers, accounting for 15.9 percent of the total, have 7 – 10 years working experience. Thus, employees at JK Horgle Company Limited typically have less work experience. Therefore, holding all other variables constant – the environment and the vehicle –, a less work experienced fuel truck driver has a higher chance to get involved in a fuel transportation accident relative to a high experienced fuel truck driver.

Regarding the grade for drivers' licence, the majority of the respondents (n=122) representing 92.4% have a licence "F," while only ten (7.6%) have a licence "B." The licence's grade is critical in determining the conditions that influence fuel transportation interruptions. As a result, it is apparent that the favoured licence grade, "F," is taken into account heavily during the recruitment process.

In terms of fuel truck drivers who have not got involved in accidents, the findings revealed that all of JK Horgle Company Limited's 132 (100%) fuel truck drivers have never been involved in any accident while performing their roles and responsibilities. This indicates that the company strongly articulates the Systems Theory with the help of the ISO 45001.

The study also aimed to find out the level of education possessed by the fuel truck drivers at JK Horgle Company Limited. It was discovered that the majority of respondents (n=71) representing 53.5 percent hold a "BECE" and 41 respondents representing 31.2 percent have an "SSCE/WASSCE" educational qualification. However, only twenty respondents (15.3%) have a bachelor's degree. The finding is unsurprising indicating that the nature of the profession does not necessitate a high level of cognitive ability, therefore, allowing management to train "BECE" holders effortlessly.

**Conditions under which fuel trucks plough the Kumasi-Accra highway (N6)**

According to research question two, the respondents were given eleven primary aspects, which identified and outlined the conditions under which fuel trucks plough the Kumasi-Accra highway (N6). The researcher chose these eleven components from the literature review and asked the respondents to

express their thoughts by indicating whether they strongly agree, agree, disagree, disagree, or strongly disagree. "Strongly agree" and "agree" were referred to as "agree", whereas "strongly disagree" and "disagree" were referred to as "disagree" for the sake of analysis. Subsequently, the researcher asked the respondents the following:

*"What are the conditions under which fuel trucks plough the Kumasi-Accra highway (N6)?"*

**Table 3: The truck does not have rollover protection**

| The truck does not have rollover protection | Frequency | Percent |
|---|---|---|
| Strongly Disagree | 107 | 81.0 |
| Neutral | 10 | 7.6 |
| Agree | 15 | 11.4 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

As a result, based on the responses received from respondents, this sub-section gives the findings of the "Truck does not have rollover protection" investigation. It is evident from Table 3 that the majority of the respondents (81.0%) strongly disagreed with the assertion. The fact that most responders (81%) disagreed with the statement raises the issue of its significance. The importance of the report underpins Aderibigbe's (2017) argument that a fuel truck without a rollover protection has a great danger of losing its drivers and passengers. Again, the statement gains significance owing to a statement made by Aderibigbe about property loss, such as fuel trucks and fuels, environmental contamination and the risk of human life, particularly for people nearby, as a

result of leakage and subsequent explosions caused by accidents. Furthermore, according to Al Chukwuma and Atelhe (2015), the above-mentioned events result in road and human insecurity.

**Table 4: Non-maintenance of fuel trucks**

| Non-maintenance of fuel trucks | Frequency | Percent |
|---|---|---|
| Strongly Disagree | 93 | 70.5 |
| Disagree | 9 | 6.8 |
| Neutral | 6 | 4.5 |
| Agree | 16 | 12.1 |
| Strongly Agree | 8 | 6.1 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

The fact that the majority of respondents (77%) disagreed with the statement "non-maintenance of fuel trucks," as shown in Table 4 raises the statement's significance. The importance of the data supports Aderibigbe's (2017) allegation that an unmaintained fuel truck has a high risk of triggering a transportation accident. According to (Aderibigbe, 2017; Bariha, Mishra, & Srivastava, 2016), this mishap will inevitably result in property loss, including fuel trucks and fuel, environmental contamination and the risk of human life, particularly for those nearby, due to leakage and subsequent explosions caused by accidents. Furthermore, according to Al Chukwuma and Atelhe (2015), the above-mentioned has the potential to lead to instability in terms of road safety and human security.

**Table 5: The truck has a stiff steering wheel**

| The truck has a stiff steering wheel | Frequency | Percent |
|---|---|---|
| Strongly Disagree | 85 | 64.4 |
| Disagree | 10 | 7.6 |
| Neutral | 17 | 12.9 |
| Agree | 8 | 6.1 |
| Strongly Agree | 12 | 9.0 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

The fact that the majority of respondents (72%) disagreed with the statement "The truck has a stiff steering wheel," and 20 (15%) respondents agreed about the same statement raises the question of the relevance of the report in Table 5. The importance of the outcome underpins Aderibigbe's (2017) argument that a vehicle with a rigid steering wheel has a high risk of being involved in a transportation accident. Al Chukwuma and Atelhe's (2015) investigation confirms the insecurity that a fuel truck's stiff steering causes both the driver and the road. (Bariha, Mishra, & Srivastava, 2016; Aderibigbe, 2017) reiterate that in the event of an adverse occurrence, countless fatalities and injuries will undoubtedly occur, as well as the destruction of natural resources such as trees and numerous properties such as shops, automobiles, houses and others in close proximity.

**Table 6: The truck has unstable tanks**

| The truck has unstable tanks | Frequency | Percent |
|---|---|---|
| Strongly Disagree | 96 | 72.7 |
| Disagree | 8 | 6.1 |
| Neutral | 6 | 4.5 |
| Agree | 15 | 11.4 |
| Strongly Agree | 7 | 5.3 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

The fact that the majority of respondents (79%) disagreed with the statement "Truck has unstable tanks" and (17%) agreed with the same statement raises the question of the statement's importance. The relevance of the data supports Aderibigbe's (2017) argument that a vehicle with unstable tanks has a high risk of being involved in a transportation catastrophe. The insecurity a fuel truck with an unsteady tank has on its driver and the road is confirmed by Al Chukwuma and Atelhe's (2015) investigation.

**Table 7: Truck head-tanker mismatch**

| Truck head-tanker mismatch | Frequency | Percent |
|---|---|---|
| Strongly Disagree | 91 | 68.9 |
| Disagree | 10 | 7.6 |
| Neutral | 9 | 6.8 |
| Agree | 16 | 12.2 |
| Strongly Agree | 6 | 4.5 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

The fact that the majority of respondents (77%) disagreed with the statement "Truck head-tanker mismatch" and (17%) agreed with the same statement raises the problem of the relevance of the information. Nevertheless, the importance of the result supports Aderibigbe's (2017) argument that a fuel truck in this condition is more likely to be involved in an accident. Furthermore, the result underpins Al Chukwuma and Atelhe's (2015) claim that the fuel truck driver and his 'mate' and the road will be highly vulnerable.

**Table 8: Improper connection of truck head-tanker at the turn-table**

| Improper connection of truck head-tanker at the turn-table | Frequency | Percent |
|---|---|---|
| Strongly Disagree | 93 | 70.5 |
| Disagree | 10 | 7.6 |
| Neutral | 6 | 4.5 |
| Agree | 14 | 10.6 |
| Strongly Agree | 9 | 6.8 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

As shown in Table 8, most respondents (78%) believe that the statement "Improper connection of truck head-tanker at the turn-table" is not a proven truth. This well-known fact raises the question of the statement's significance. The statement's relevance supports Aderibigbe's (2017) claim that a fuel truck in such a condition is more likely to cause transportation chaos. Similarly, Planas-Cuchi, Gasulla, Ventosa and Casal (2004) suggested that a driver operating such a fuel truck can easily lose control with disastrous consequences. Aderibigbe's assertion of environmental degradation and human life loss near the crash site is supported by such a devastating effect.

**Table 9: The truck has stiff gear**

| The truck has stiff gear | Frequency | Percent |
|---|---|---|
| Strongly Disagree | 90 | 68.2 |
| Disagree | 12 | 9.1 |
| Neutral | 8 | 6.1 |
| Agree | 9 | 6.8 |
| Strongly Agree | 13 | 9.8 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

Table 9 shows a depiction of the varied responses from the respondents. Because most responders (77%) disagreed with the statement, it follows that their point of view is the accepted truth. This well-known fact raises the question of the statement's importance. The statement's relevance underpins Aderibigbe's (2017) assertion that a fuel truck with stiff gear has a significant risk of tumbling, falling and spilling fuel onto the road. According to Al Chukwuma and Atelhe (2015), a fallen and spilt fuel threatens road safety and human security.

**Table 10: The truck has poor braking system**

| The truck has poor brakes | Frequency | Percent |
|---|---|---|
| Strongly Disagree | 97 | 73.5 |
| Disagree | 11 | 8.3 |
| Neutral | 9 | 6.8 |
| Agree | 10 | 7.5 |
| Strongly Agree | 5 | 3.9 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

Table 10 shows a representation of respondents' replies to the statement. Because most respondents (82%) disagreed with the assertion, the fact is established. This proven truth raises the question of the statement's significance. The statement's value underpins Aderibigbe's (2017) claim that a fuel truck with bad brakes is more likely to lose control, crush and spill fuel onto the road and the environment. The statement's relevance also supports Bariha, Mishra and Srivastava's (2016) claim that such an accident is more likely to result in fatalities and destruction.

**Table 11: The Truck has chassis issues**

| The truck has chassis issues | Frequency | Percent |
|---|---|---|
| Strongly Disagree | 90 | 68.2 |
| Disagree | 8 | 6.1 |
| Neutral | 11 | 8.3 |
| Agree | 13 | 9.8 |
| Strongly Agree | 10 | 7.6 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

Table 11 depicts the genuine picture of respondents' reactions to the proposition. The position of the majority of responders (74%) establishes a fact regarding the statement. The statement's significance is called into question by the known reality. The relevance of the assertion is shown in a linear relationship with Aderibigbe's (2017) remark that a fuel truck in such a situation can stumble and fall. According to Aderibigbe, a falling fuel truck tends to pour fuel into the environment and a polluted environment impacts the security of persons close and the road's safety (Al Chukwuma & Atelhe, 2015).

**Table 12: Uninstallation of air suspension balloon in truck**

| Uninstallation of air suspension balloon in truck | Frequency | Percent |
|---|---|---|
| Strongly disagree | 20 | 15.3 |
| Disagree | 6 | 4.5 |
| Neutral | 77 | 58.3 |
| Agree | 13 | 9.8 |
| Strongly agree | 16 | 12.1 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

Table 12 shows the actual replies of the respondents to the statement. Most respondents (58%) were unsure about the uninstallation of an air suspension balloon on JK Horgle Company Limited's fuel trucks. According to Aderibigbe's (2017) statement, if a suspension balloon is placed, the fuel truck driver's life will be protected when the fuel truck tumbles and falls and the converse holds. This outcome neither supports nor refutes Aderibigbe's assertion. However, the answer to this question implies that no part of the training and information offered and given to fuel tanker drivers addresses the air suspension balloon, leaving them utterly unaware of its presence or absence. Consequently, fuel trucks without this balloon will not be able to lessen the intensity of injuries and fatalities in motor accidents. Therefore, it is suitable for the HSSE manager by the support of the company's management to replace all fuel trucks lacking this balloon.

**Table 13: Tires of the truck not replaceable upon expiry**

| Tires of the truck not replaceable upon expiry | Frequency | Percent |
|---|---|---|
| Strongly disagree | 43 | 32.6 |
| Disagree | 41 | 31.1 |
| Neutral | 11 | 8.3 |
| Agree | 8 | 6.0 |
| Strongly agree | 29 | 22.0 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

The majority of the respondents (64%) answers give a fact regarding the assertion. The reality of the statement establishes its significance. The statement's relevance aligns with Aderibigbe's (2017) assertion that a fuel truck with expired tire(s) can topple, fall and spill fuel at any point during delivery.

Objective two indicates that JK Horgle Company Limited follows good procedures concerning its fuel trucks, except for the uninstallation of an air suspension balloon, which fuel truck drivers are unaware of its presence or absence. Nonetheless, most of the respondents affirmed that the company's fuel trucks plough under conducive conditions. As a result, it is expected that the number of accidents will be low, as predicted by the Systems Theory. This theory states that if the vehicle is placed in good condition with a disciplined driver and a conducive environment, fuel transportation mishaps should not occur. Therefore, it is not surprising that fuel trucks have recorded no incidents of road accidents in this company.

The statistical depiction of the conditions under which fuel trucks ply the Kumasi-Accra highway (N6) can be found in Table 14.

**Table 14: Statistical description of the conditions under which fuel trucks plough the Kumasi-Accra highway (N6)**

| Conditions of Fuel Trucks | Disagree | | Neutral | | Agree | | Total | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| No rollover protection | 107 | 81 | 10 | 8 | 15 | 11 | 132 | 100 |
| Non-maintenance of trucks | 102 | 77 | 6 | 5 | 24 | 18 | 132 | 100 |
| Stiff steering wheel | 95 | 72 | 17 | 13 | 20 | 15 | 132 | 100 |
| Unstable tanks | 104 | 79 | 6 | 4 | 22 | 17 | 132 | 100 |
| Truck head-tanker mismatch | 101 | 77 | 9 | 6 | 22 | 17 | 132 | 100 |
| Improper connection of truck head to a tanker at the turn table | 103 | 78 | 6 | 4 | 23 | 18 | 132 | 100 |
| Stiff gear | 102 | 77 | 8 | 6 | 22 | 17 | 132 | 100 |
| Poor brakes | 108 | 82 | 9 | 7 | 15 | 11 | 132 | 100 |
| Chassis issue | 98 | 74 | 11 | 8 | 23 | 18 | 132 | 100 |
| Uninstallation of air suspension balloon | 26 | 20 | 77 | 58 | 29 | 22 | 132 | 100 |
| Tires not replaceable upon expiry | 84 | 64 | 11 | 8 | 37 | 28 | 132 | 100 |

Source: Field survey (2021)

**Conditions that influence fuel transportation disruptions on the Kumasi-Accra highway (N6)**

According to research question three, respondents were given thirteen vital elements, which investigated the conditions that influence fuel transportation disruptions on the Kumasi-Accra route (N6). The researcher chose these thirteen elements from the literature study and respondents were asked to express their thoughts by indicating whether they "strongly disagree", "disagree", "neutral", "agree", or "strongly agree". "Strongly agree" and "agree" were referred to as "agree", whereas "strongly disagree" and "disagree" were referred to as "disagree" for the sake of analysis. Following that, the respondents were asked:

*"What are the conditions that influence fuel transportation disruptions on the Kumasi-Accra highway (N6)?"*

**Table 15: Driver responsibility is not effectively communicated**

| Driver responsibility is not effectively communicated | Frequency | Percent |
|---|---|---|
| Strongly disagree | 92 | 69.7 |
| Disagree | 15 | 11.4 |
| Neutral | 8 | 6.1 |
| Agree | 5 | 3.8 |
| Strongly agree | 12 | 9.0 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

The facts regarding the results are depicted in Table 15. The fact that most respondents (81%) disagree with the statement raises the question of its importance. Nevertheless, the established significance confirms (Darabont,

Antonov, & Bejinariu, 2017; Soltanifar, 2022; Campailla, Martini, Minini, & Sartor, 2019) statements of the leadership of the ISO 45001. According to them, clause 5.3 of the ISO 45001 requires top management to communicate effectively with employees and others under their authority while adhering to its OHS policy. According to (Darabont et al., 2017; Soltanifar, 2022; Campailla et al., 2019), the importance of effective communication of driver responsibility through the support phase (clause 7) of ISO 45001 can be accomplished either internally or externally, but it must be acknowledged. Furthermore, (Zeng, Shi, & Lou, 2007; Robson et al., 2007) opinions support the idea that communication is a critical component of a good OHSMS. As a result, JK Horgle Company Limited ensures the effective communication of obligations to its subjects. This facet of leadership is critical to the company's efficient operations.

**Table 16: Poor health and safety policy on driving**

| Poor health and safety policy on driving | Frequency | Percent |
|---|---|---|
| Strongly disagree | 91 | 68.9 |
| Disagree | 14 | 11.6 |
| Neutral | 10 | 7.6 |
| Agree | 12 | 9.0 |
| Strongly agree | 5 | 3.8 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

JK Company Limited respondents were questioned if the company had a poor health and safety policy regarding driving. The outcomes of their responses are summarised in table 16. When the majority of the respondents

(80%) disagree with the statement, it confirms the statement's truth. The importance of a statement is called into question by an established truth. The statement's relevance supports (Darabont, Antonov, & Bejinariu, 2017; Soltanifar, 2019; Campailla, Martini, Minini, & Sartor, 2019) positions that sub-clause 5.2 of ISO 45001's clause 5 (leadership) becomes the first step in showing and providing management system stability. The relevance of the finding underpins (Darabont et al., 2017; Soltanifar, 2022; Campailla et al., 2019) claims that the appropriateness of a health and safety policy should include employee (fuel truck drivers) consultation and participation.

**Table 17: Training sessions are not provided for fuel truck drivers**

| Training sessions are not provided for fuel truck drivers | Frequency | Percent |
|---|---|---|
| Strongly disagree | 90 | 68.1 |
| Disagree | 16 | 12.1 |
| Neutral | 6 | 4.6 |
| Agree | 12 | 9.1 |
| Strongly agree | 8 | 6.1 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

The majority of respondents (80%) disagreed with management not giving training sessions for the company's fuel truck drivers. The significance of the report is called into question by this acknowledged truth. This statement's significance underpins Mohammadfam et al. (2016) assertion that sufficient training is one of the most important components in an OHSMS. The statement's importance also supports Redinger and Levine's (1998) assertion that an effective OHSMS cannot exist without a training component. Again, the

lack of training sessions for fuel truck drivers underpins Aderibigbe's (2017) assertion that fuel truck drivers are prone to fuel transportation disasters.

**Table 18: Driver's failure to identify hazards and risks in the execution of duties**

| Driver's failure to identify hazards and risks in the execution of duties | Frequency | Percent |
|---|---|---|
| Strongly disagree | 86 | 65.2 |
| Disagree | 12 | 9.1 |
| Neutral | 9 | 6.8 |
| Agree | 14 | 10.6 |
| Strongly agree | 11 | 8.3 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

Because most respondents (74%) disagreed with the assertion, it is proven that JK Horgle Company drivers can identify hazards and risks while performing their tasks. This fact calls into question the statement's importance. This statement's significance underpins Van Elslande's (2003) claim that a driver takes decisions like identifying hazards and risks and if unable to do so, contribute to the development of road failure. (Darabont, Antonov, & Bejinariu, 2017; Soltanifar, 2022; Campailla, Martini, Minini, & Sartor (2019) stated that the operational control and planning stage (sub-clause 8.1) of the operation phase (clause 8) of the ISO 45001 urges employees to identify hazards and OHS risks, hence, affirms the relevance of the statement.

**Table 19: The driver has a low competence level in executing duties**

| The driver has a low competence level in executing duties | Frequency | Percent |
|---|---|---|
| Strongly disagree | 90 | 68.2 |
| Disagree | 16 | 12.1 |
| Neutral | 12 | 9.1 |
| Agree | 6 | 4.5 |
| Strongly agree | 8 | 6.1 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

Because most of the respondents (80%) disagreed with the assertion, it establishes a fact in Table 19. This well-known fact raises the question of importance. This clear relevance underpins (Darabont, Antonov, & Bejinariu, 2017; Soltanifar, 2022; Campailla, Martini, Minini, & Sartor, 2019) comments concerning competence (sub-clause 7.2) of ISO 45001's clause 7 (support). Sub-clause 7.2 states that management must employ all available resources to improve worker competence.

**Table 20: Driver not aware of the consequences of fuel transportation disruption**

| The driver is not aware of the consequences of fuel transportation disruption | Frequency | Percent |
|---|---|---|
| Strongly disagree | 89 | 67.4 |
| Disagree | 15 | 11.3 |
| Neutral | 6 | 4.5 |
| Agree | 17 | 13.0 |
| Strongly agree | 5 | 3.8 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

Another issue was whether or not the driver was aware of the consequences of fuel transportation disruption. When the majority of respondents (79%) disagree with a proposition, it becomes a reality. The factual determination raises the question of the statement's importance. The statement's relevance underpins Al Chukwuma and Atelhe's (2015) assertion that even the slightest disruption in fuel transportation has disastrous implications, putting road safety and human security at risk.

**Table 21: Driver does not have documented guidelines to ensure safe driving**

| Driver does not have documented guidelines to ensure safe driving | Frequency | Percent |
|---|---|---|
| Strongly disagree | 87 | 65.9 |
| Disagree | 15 | 11.3 |
| Neutral | 10 | 7.6 |
| Agree | 9 | 6.8 |
| Strongly agree | 11 | 8.4 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

One hundred and two respondents (n=102) disagreed with the assertion when determining whether or not drivers have a documented guideline to ensure safe fuel transportation via road. Because most respondents (77%) disagreed with the statement, it is established as a fact. This proven truth raises the question of the statement's significance. The European Process Safety Centre's (EPSC) (1994) foundation for producing a safety management system guideline underscores this recognised significance. According to (Darabont, Antonov, & Bejinariu, 2017; Soltanifar, 2022; Campailla, Martini, Minini, & Sartor, 2019),

management review (sub-clause 9.3) and performance evaluation (clause 9) of ISO 45001 mandate the documentation of OHSMS, which asserts the documentation of guideline to ensure the safe transportation of fuel.

**Table 22: No emergency warning on the fuel truck**

| No emergency warning on the fuel truck | Frequency | Percent |
|---|---|---|
| Strongly disagree | 100 | 75.8 |
| Disagree | 9 | 6.8 |
| Neutral | 12 | 9.1 |
| Agree | 8 | 6.0 |
| Strongly agree | 3 | 2.3 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

The respondents' feedback on the fuel truck's lack of emergency notice is summarised in Table 22. Since most respondents (83%) disagreed with the statement, the Table shows the statement's truth. The fact that the statement is true raises the question of its relevance. The statement's significance underpins statements by (Darabont, Antonov, & Bejinariu, 2017; Soltanifar, 2022; Campailla, Martini, Minini, & Sartor, 2019) that "emergency preparedness and response" (sub-clause 8.2) of ISO 45001's clause 8 (operation) plays a critical role in work operations, particularly high-risk ones.

**Table 23: Leadership does not permit fuel driver consultation and participation in formulating fuel transportation policies**

| Leadership does not permit fuel driver consultation and participation in formulating fuel transportation policies | Freq. | Per. |
|---|---|---|
| Strongly disagree | 59 | 44.6 |
| Disagree | 20 | 15.3 |
| Neutral | 28 | 21.2 |
| Agree | 13 | 9.8 |
| Strongly agree | 12 | 9.1 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

The researcher also asked leadership if they consult with employees and participate in fuel transportation regulations. The fact was established because most of the respondents (60%) disagreed with the assertion. The factual determination raises the question of the statement's importance. The statement's significance supports (Foulke Jr., 2019; Darabont, Antonov, & Bejinariu, 2017; Soltanifar, 2022; Campailla, Martini, Minini, & Sartor, 2019) assertions that the new management standard (ISO 45001) strongly encourages employee consultation and participation in decision-making and assessment processes.

**Table 24: Increased temperatures such as hot days and cold nights influence fuel transportation disruption**

| Increased temperatures such as hot days and cold nights influence fuel transportation disruption | Freq. | Per. |
|---|---|---|
| Strongly disagree | 6 | 4.5 |
| Disagree | 17 | 13.0 |
| Neutral | 7 | 5.3 |
| Agree | 18 | 13.6 |
| Strongly agree | 84 | 63.6 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

When asked if higher temperatures, such as hot days and cold nights, impact fuel transportation interruption, the majority of respondents (n=102) strongly agreed. The relevance of respondents' replies to whether or not elevated temperatures, such as hot days and cold nights, cause fuel transportation delays is shown in Table 24. The majority of responders (77%) agreed with the assertion, indicating that the statement was true. This proven truth raises the question of the statement's significance. The relevance of the declaration supports Camden et al. (2020) claim that sunny weather makes driving difficult. Taylor and Philp's (2010) argument that an increase in temperature combined with increased radiation from the sun's energy may lower the long span of road surface, thereby disrupting the fuel transportation process in the long term, establishing the statement's significance once more.

**Table 25: Weather seasons such as the rainy and dry seasons influence fuel transportation disruption**

| Weather seasons such as the rainy and dry seasons influence fuel transportation disruption | Frequency | Percent |
|---|---|---|
| Strongly disagree | 10 | 7.6 |
| Disagree | 19 | 14.4 |
| Agree | 15 | 11.3 |
| Strongly agree | 88 | 66.7 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

Weather seasons, such as wet and dry seasons, were asked whether or not they have an impact on fuel transportation disruption. The fact that most respondents (78%) agreed with the statement demonstrates a fact about the report. The establishment of the truth raises the issue of significance about the information. The statement's value underpins Twerefou, Adjei-Mantey and Strzepek's (2014) claim that heavy rains cause new potholes to form while old ones deepen fast and readily, indicating the statement's significance.

**Table 26: Nature of roads such as potholes and cracks influence fuel transportation disruption**

| Nature of roads such as potholes and cracks influence fuel transportation disruption | Frequency | Percent |
|---|---|---|
| Strongly disagree | 12 | 9.1 |
| Disagree | 9 | 6.8 |
| Agree | 10 | 7.6 |
| Strongly agree | 101 | 76.5 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

One hundred and one of the respondents (n=111) agreed that the nature of roads, such as potholes and cracks, impacts fuel transportation interruption. Given the initial finding, it appears that the majority of respondents (84%) agree with the type of road impacting fuel transportation disruption. This disputed reaction establishes a fact about the statement and proves its significance. This statement's relevance underpins Twerefou, Adjei-Mantey and Strzepek's (2014) claim that potholes on roadways disrupt the transportation process.

**Table 27: Health and safety policy on driving does not conform to statutory compliance**

| Health and safety policy on driving does not conform to statutory compliance | Frequency | Percent |
|---|---|---|
| Strongly disagree | 97 | 73.5 |
| Disagree | 20 | 15.2 |
| Agree | 15 | 11.3 |
| **Total** | **132** | **100.0** |

Source: Field survey (2021)

Respondents were asked if their health and safety policies on driving complied with the law. The fact is established because most responders (89%) disagreed with the assertion. The establishment of the fact raises questions regarding the statement's importance. Nevertheless, the significance of the statement conforms to (Darabont, Antonov, & Bejinariu, 2017; Soltanifar, 2022; Campailla, Martini, Minini, & Sartor, 2019) statements that the definition and approval of the organisation's health and safety policy (sub-clause 5.2) is the first step to demonstrating and providing stability to the management system. Next is to consider conformity to statutory compliance. The company achieves conformity by simply loading at BOST's APD. The achievement of

this conformity is so because BOST serves as an arm of the Government of Ghana that ensures statutory compliance.

Most respondents affirmed that all the indicators presented are conditions necessary to influence fuel transportation disruptions regarding the third objective. This means that fuel transportation accidents will rise if the required attention is not provided to these conditions. However, as a result, the number of casualties is projected to be minimal, as predicted by the systems theory. This theory implies that fuel transportation mishaps should not occur with a suitable environment, a well-trained driver and a well functional vehicle. As a result, it is not surprising that this company has never had a road accident involving fuel trucks.

The statistical depiction of the conditions that influence transportation disruption on the Kumasi-Accra highway (N6) can be found in Table 28.

**Table 28: A statistical depiction of the conditions that influence transportation disruption on the Kumasi-Accra highway (N6)**

| Conditions that influence fuel transportation disruption | Disagree | | Neutral | | Agree | | Total | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| Non-effective communication | 107 | 81 | 8 | 6 | 17 | 13 | 132 | 100 |
| Poor H&S policy | 105 | 80 | 10 | 7 | 17 | 13 | 132 | 100 |
| No training sessions | 106 | 80 | 6 | 5 | 20 | 15 | 132 | 100 |
| Failure to identify hazards and risks | 98 | 74 | 9 | 7 | 25 | 19 | 132 | 100 |
| Low competence level | 106 | 80 | 12 | 9 | 14 | 11 | 132 | 100 |
| Unaware of consequences of transportation disruption | 104 | 79 | 6 | 4 | 22 | 17 | 132 | 100 |
| No documented guideline | 102 | 77 | 10 | 8 | 20 | 15 | 132 | 100 |
| No emergency warning | 109 | 83 | 12 | 9 | 11 | 8 | 132 | 100 |
| No consultation and participation in transportation policies | 79 | 60 | 28 | 21 | 25 | 19 | 132 | 100 |
| Temperature influence on transportation disruption | 23 | 18 | 7 | 5 | 102 | 77 | 132 | 100 |
| Weather influence on transp. disruption | 29 | 22 | - | - | 103 | 78 | 132 | 100 |
| Road nature influence transportation disruption | 21 | 16 | - | - | 111 | 84 | 132 | 100 |
| H & S do not conform to statutory compliance | 117 | 89 | - | - | 15 | 11 | 132 | 100 |

Source: Field survey (2021)

**Chapter Summary**

The results of the research questions are summarised in this section. First, fuel truck drivers at JK Horgle Company limited had all the necessary characteristics and documentations which formed their background for selection into the organisation. In addition, the conditions of fuel trucks in the company that ply the Kumasi-Accra Highway (N6) are generally good based on the results. Again, the fuel truck drivers consented that all the conditions that were presented to them concerning the third objective are liable to cause a road mishap and this is evident based on the achieved results.

# CHAPTER FIVE

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## Introduction

This chapter summarises the study's primary findings and the results and conclusions. This chapter also presents recommendations for improving occupational health and safety management systems in Ghana's fuel transportation sector, particularly on the Kumasi-Accra route (N6), which uses Bulk Road Vehicles (BRVs).

## Summary

The study assessed the efficiency for the adoption and implementation of OHSMSs for fuel transportation in the downstream oil and gas industry along the Kumasi-Accra Highway (N6). The study's questions sought answers on the background of fuel truck drivers who ply the Kumasi-Accra Highway (N6). It also assessed the conditions under which fuel trucks ploughed the Kumasi-Accra highway (N6) and examined the conditions that impact fuel transportation disruptions on the highway. In order to explain and describe the connection between these variables, the study used an explanatory research design. Questionnaires were given to 132 fuel truck drivers at JK Horgle Company Limited in order to address the study's objectives. The Social Sciences Statistical Package (SPSS) software version 26 was used to clean, enter and analyse the data using descriptive statistics like frequencies and percentages.

**Key Findings**

The following are the study's major findings:

1. Fuel truck drivers at JK Horgle Company Limited have a solid background in operating their fuel trucks.
2. Generally, fuel trucks in JK Horgle Company Limited have good conditions to ply the Kumasi-Accra highway (N6).
3. Again, fuel truck drivers at JK Horgle Company Limited affirmed the conditions that are liable to influence fuel transportation disruptions on the Kumasi-Accra highway (N6).

**Conclusions**

Based on the findings, the researcher concluded that JK Horgle Company Limited's OHSMSs comply with best practices. As a result, the company applies the Systems Theory where only vehicles in better conditions are used by well-disciplined drivers who have the appropriate background and executes tasks in a suitable environment. It also implies that JK Company Limited ensures the synergy between the variables that make up the Systems Theory. However, this synergy cannot be perfect, yet this company ensures and maintains a high standard of the relationship between their fuel truck drivers, fuel trucks (vehicles) and the conditions that influence the transportation process of fuel (environment) of the Systems Theory. Furthermore, although fuel truck drivers were unsure of the uninstallation of air suspension balloons in fuel trucks, this organisation generally seems to be performing well. As a result, it is unsurprising that JK Horgle Company Limited has never been involved in a calamity since its establishment. However, the researcher can also conclude that the recent fuel transportation mishaps on the Kumasi-Accra highway (N6)

and across the entire country result from the non-compliance of the new ISO MSS (ISO 45001) and statutory compliance.

**Recommendations**

The summary of findings and conclusions revealed some concerns. The researcher, therefore, recommends the following:

1. All fuel transporting companies should have fuel truck drivers who have solid backgrounds to operate fuel trucks.
2. All fuel transporting agencies should obtain fuel trucks that are in better to perfect conditions in order to ply the various roads safely.
3. Again, before carrying on a consignment, all fuel transporting companies should obtain all the necessary conditions such as the weather, the appropriate route and among others, that are likely to result into a fuel transportation mishap.

**Suggestions for Further Research**

The study was conducted among fuel truck drivers at JK Horgle Company Limited on fuel transportation in the Kumasi-Accra highway (N6). Therefore, the study recommends that other studies can investigate other fuel transporting organisations like S. O. Frimpong Transport Company Limited, Riet Transport Company Limited and J. K. Ahaidome Company Limited. Again, other studies can investigate other routes other than the Kumasi-Accra Highway (N6) as utilised in this study. In addition, other studies can proffer policies and their implementation strategies that can reduce and/or eradicate mishaps in the transportation of fuel. Furthermore, future research could utilise a different measurement standard than the ISO 45001 as used in this study.

Finally, instead of descriptive statistics like those used in this study, inferential statistics could be employed.

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## APPENDIX A

## UNIVERSITY OF CAPE COAST

## INSTITUTE FOR OIL AND GAS STUDIES

## QUESTIONNAIRE FOR FUEL TRUCK DRIVERS AT JK HORGLE CO. LTD. WHO PLOUGH THE KUMASI-ACCRA HIGHWAY (N6)

This questionnaire is designed to assess the efficiency of OHSMSs for fuel transportation in the downstream oil and gas industry on the Kumasi-Accra highway (N6). It will enable the researcher to improve further the Occupational Health and Safety (OHS) culture and provide an innovative and robust safety mechanism to help the business succeed in the downstream oil and gas industry regarding fuel transportation. This research is strictly for academic purposes. Information provided would be treated with the utmost confidentiality. No individual or organisation will be compromised in any way. Thank you.

*Please tick '√' where appropriate*

**SECTION 1: Socio-Demographic Characteristics of Respondents**

1. Gender of respondent

   [ ] Male [ ] Female

2. How old are you?

   [ ] 25 – 30 [ ] 31 – 36 [ ] 37 – 42

   [ ] 43 – 48 [ ] 49 – 54 [ ] 55 and above

   Others, (please specify) …….

3. Level of years of driving experience at JK Horgle Company Limited

   [ ] 1 – 3 years [ ] 4 – 6 years [ ] 7 – 10 years

   Others, (please specify) …….

4. Level of the grade of the driver's license

   [ ] 'A' [ ] 'B' [ ] 'C'

   [ ] 'D' [ ] 'E' [ ] 'F'

5. Have been involved in a fuel transportation accident(s)

   [ ] Once [ ] Twice [ ] None Others,

   (Please specify) …

6. The educational level of the truck driver.

   [ ] BECE [ ] SSCE/WASSCE [ ] Bachelor

   Others, (Please specify) …..

**SECTION 2: Conditions under which fuel trucks ply the Kumasi-Accra highway (N6)**

**Instructions:** Using the scale below, please tick '√' your level of agreement or disagreement with the following:

| | Statement | Strongly Agree (5) | Agree (4) | Neutral (3) | Disagree (2) | Strongly disagree (1) |
|---|---|---|---|---|---|---|
| **7** | The truck does not have rollover protection | | | | | |
| **8** | Non-maintenance of trucks | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **9** | The truck has a stiff steering wheel | | | | | |
| **10** | Trucks have unstable tanks | | | | | |
| **11** | Truck head-tanker mismatch | | | | | |
| **12** | Improper connection of truck head to a tanker at the turn-table | | | | | |
| **13** | The truck has stiff gear | | | | | |
| **14** | The truck has poor brakes | | | | | |
| **15** | The truck has chassis issues | | | | | |
| **16** | Uninstallation of air suspension balloon in truck | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **17** | Tires of the truck not replaceable upon expiry | | | | | |

**SECTION 3: Conditions that influence fuel transportation disruptions on the Kumasi-Accra highway (N6)**

| **Statement** | | **Strongly Agree (5)** | **Agree (4)** | **Neutral (3)** | **Disagree (2)** | **Strongly disagree (1)** |
|---|---|---|---|---|---|---|
| **18** | Driver responsibility and role are not effectively communicated | | | | | |
| **19** | Poor health and safety policy on driving | | | | | |
| **20** | Training sessions are not provided for drivers | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **21** | Driver's failure to identify hazards and risks in the execution of duties | | | | | |
| **22** | The driver has a low competence level in executing duties | | | | | |
| **23** | Driver not aware of the consequences of fuel transportation disruption | | | | | |
| **24** | Driver does not have documented guidelines to ensure safe driving | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **25** | No emergency warning on the truck | | | | | |
| **26** | Leadership does not permit driver consultation and participation in formulating transportation policies | | | | | |
| **27** | Increased temperatures such as hot days and cold nights influence fuel transportation disruption | | | | | |
| **28** | Weather seasons such as the rainy and dry seasons | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | influence fuel transportation disruption | | | | | |
| **29** | Nature of roads such as potholes and cracks influence fuel transportation disruption | | | | | |
| **30** | Health and safety policy on driving does not conform to statutory compliance | | | | | |

**APPENDIX B**

**ETHICAL CLEARANCE**

# UNIVERSITY OF CAPE COAST

## INSTITUTIONAL REVIEW BOARD SECRETARIAT

TEL: 0558093143 / 0508878309
E-MAIL: irb@ucc.edu.gh
OUR REF: UCC/IRB/A/2016/1480
YOUR REF:
OMB NO: 0990-0279
IORG #: IORG0009096

10TH AUGUST, 2022

Mr. Steve Amoako Baafi

Institute for Oil and Gas Studies

University of Cape Coast

Dear Mr. Baafi,

**ETHICAL CLEARANCE - ID (UCCIRB/CHLS/2021/52)**

The University of Cape Coast Institutional Review Board (UCCIRB) has granted Provisional

Approval for the implementation of your research Occupational Health and Safety Management Systems (OHSMSs) for Fuel Transportation in Ghana. This approval is valid from 10th August, 2022 to 9th August, 2023. You may apply for a renewal subject to submission of all the required documents that will be prescribed by the UCCIRB.

Please note that any modification to the project must be submitted to the UCCIRB for review and approval before its implementation. You are required to submit periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation.

You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours faithfully,

Samuel Asiedu Owusu, PhD

UCCIRB Administrator

ADMINISTRATOR
INSTITUTIONAL REVIEW BOARD
UNIVERSITY OF CAPE COAST