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Assessment of the chemical hazard awareness of petrol tanker driver: A case study

Ahmad Noor Syimir Fizal [a], Md. Sohrab Hossain [b,*], Abbas F.M. Alkarkhi [a], Adeleke Abdulrahman Oyekanmi [b], Siti Rahayu Mohd Hashim [c], Nor Afifah Khalil [a], Muzafar Zulkifli [a], Ahmad Naim Ahmad Yahaya [a,**]

[a] Malaysian Institute of Chemical and Bioengineering Technology, Universiti Kuala Lumpur (UniKL), Melaka, Malaysia
[b] Division of Environmental Technology, School of Industrial Technology, Universiti Sains Malaysia (USM), Penang, Malaysia
[c] Faculty of Science & Natural Resources, Universiti Malaysia Sabah (UMS), Sabah, Malaysia

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ABSTRACT

Understanding the tanker driver hazard awareness on chemical exposure is important to ensure that they are fortified with the appropriate information regarding the risk of their occupation. This present study was conducted to determine the awareness of the petrol tanker driver on the chemical exposure during transportation petroleum product. The assessment on hazardous awareness of the petrol tank driver was conducted through questionnaire survey. Wherein, the questionnaire was designed with considering the variables of age of the driver, working experience, working hours in a day and knowledge on chemical hazard presence in the petroleum oil. A reliability test of Cronbach's Alpha was performed to validate the questionnaire and the Chi-Square test was conducted to determine the correlation among the studied variables. The findings of the present study revealed that the drivers who are frequently come into direct contact with petrol cannot identify the spillage had occurred during working. The study identified that there is an urgency to conduct training on safe handling of petroleum oil in order to eliminate the risk of chemical hazards exposure to the tanker driver.

1. Introduction

Increase in population has contributed to the increase in demand for petrol consumption on the improvement of social welfare specifically in transportation. Malaysia has consumed 28.699 kilotonnes of petroleum-based energy in 2015 and a cumulative of 281799 kilotonnes of petroleum-based energy from 2005 to 2015 (Energy Commission, 2018). A steady increase from 14 million to 19 million active vehicles on the road in Malaysia was recorded by the Malaysian Road and Transport Department from 2008 until 2015 (MRTD, 2015). Intensive usage of vehicle fuel would mean the distribution of petrol stations across communities keep increasing. Currently, there are 1470 petrol stations in Malaysia.

Volatile organic compounds contained in petrol are organic chemicals that have a low boiling point and high vapour pressure (Edokpolo et al., 2014; Hilpert and Breysse, 2014; Neghab et al., 2015). This characteristic making these organic compound capable to evaporate easily under room temperature (Edokpolo et al., 2014). Organic compounds such as ethanol, methyl tert-butyl ether (MTBE), benzene, toluene, and xylene (BTX) might be emitted through evaporation while pumping fuel in a vehicle (Hilpert et al., 2015; Mitri et al., 2015). Volatile organic compounds (VOCs) in petrol such as the BTXs have been known to contribute ozone depletion and enhances the global greenhouse gases (Niaz et al., 2015; Syimir et al., 2018a). Other adverse effects associated with these air pollutants are global warming, acid rain, and photochemical smog (Kamal et al., 2016; Rad et al., 2014). BTXs have significant toxic effects on the human central nervous system (Li et al., 2015; Syimir et al., 2018a). Occupational exposures to these compounds lead to high percentage to get lung cancer, bladder cancer and leucocythemia (Kamal et al., 2016; Mitri et al., 2015). Long-term exposure to VOCs might associate with gene mutation cell-damaging and increased risks of cardiopulmonary mortality (Mitri et al., 2015; Zhu et al., 2012). Humans may expose to BTXs by breathing polluted air, their dietary intake and through dermal contact (Gungormus et al., 2014; Liao et al., 2018). The

* Corresponding author.
** Corresponding author.
E-mail addresses: sohrab@usm.my (Md. Sohrab Hossain), ahmadnaim@unikl.edu.my (A.N. Ahmad Yahaya).

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health effects that come from exposure to VOCs and BTXs are raising concern for worker handling the petrol product such as petrol pump attendance, petrol tanker driver and pump station customer (Edokpolo et al., 2014; Hilpert et al., 2015). Legal and standard were enhanced to minimize the exposure of petro chemicals on petrol tanker driver in order to reduce the risk of having any health effect. Permissible exposure limit (PEL) is the limit of exposure which is considered safe to work at a given time. PEL is separated under 2 categories which are Time Weighted Average (TWA) of 8 hours working exposure in a day and short-term exposure limit (STEL) of 15 min of working exposure in a day (NIOSH, 2015). Table 1 shows the permissible exposure limit of TWA and STEL for several hazardous chemical components in petrol set by Occupational Safety and Health Act (OSHA) and National Institute of Industrial Safety and Health (NIOSH).

Transportation of petrol is control by the petrol companies, where each company had assigned specific vendors (known as tanker company) to transport the product to their own petrol stations. Petrol station is required to inform the refinery depot that their product need to be refilled and the order will be sent out to the tanker company. Tanker company will send out their petrol tanker driver to the refinery depot to collect the product based on the order and drive out the product from the depot to the respective petrol station where the tanker driver is required to transfer the product into the petrol stations storage tank. Petrol tanker driver must then report back to the refinery depot to verify that the transfer had been made safely and lastly report back to the tanker company to complete the process. Petrol tanker drivers are required to handle the petrol product in bulk amount and susceptible to high risk of exposure especially during loading and unloading of petrol into the petrol station where each session took about 1–2 h depending on the amount (Syimir et al., 2018b).

Understanding the hazard awareness level of tanker driver is vital to ensure that they are equipped with the proper knowledge and understanding regarding the risk of their occupation (Bendickson et al., 2018; Niaz et al., 2015). Studies showed that level of awareness of tanker driver had a significant correlation with the employee's reaction to hazard while working (Rogério dos Santos Alves and Alex Soares de Souza, 2014; Zainal Abidin et al., 2018). Occupational Safety and Health Administration (OSHA) regulations enforced the employer to provide training to prepare the tanker driver with sufficient input regarding their working hazard (Rogério dos Santos Alves and Alex Soares de Souza, 2014).

Table 1
Permissible exposure limit of hazardous components in petrol.

Chemical Name	Chemical Formula	Permissible Exposure Limit		Conversion of 1 ppm
		OSHA	NIOSH	
Benzene	C_6H_6	TWA 1.0 ppm STEL 5.0 ppm	TWA 0.1 ppm STEL 1.0 ppm	3.19 mg/m^3
Toluene	$C_6H_5CH_3$	STEL 150 pm at 10 min maximum peak	TWA 100 ppm STEL 150 ppm	3.77 mg/m^3
m-xylene	$C_6H_4(CH_3)_2$	TWA 150 ppm	TWA 100 ppm STEL 150 ppm	4.34 mg/m^3
o-xylene	$C_6H_4(CH_3)_2$	TWA 150 ppm	TWA 100 ppm STEL 150 ppm	4.34 mg/m^3
p-xylene	$C_6H_4(CH_3)_2$	TWA 150 ppm	TWA 100 ppm STEL 150 ppm	4.41 mg/m^3

TWA-daily exposure on averaged to an 8-hour work/day.
STEL (short-term exposure limit of 15 min).
Sources* NIOSH (NIOSH, 2015)

Handling petrol proves to have significant risk on tanker driver health in short and long run making it important to identify the awareness level of the tanker driver (Mitri et al., 2015; Neghab et al., 2015). Thus, the present study was conducted to assess the knowledge on hazards of tanker drivers during handling and transporting petroleum oil. The finding of the study would be beneficial to the petroleum oil companies to reduce the occupational hazard of their tanker driver from chemical exposure by providing suitable information related to the risk of their occupation.

2. Materials and method

2.1. Development of question survey

The s present study was conducted with the ethical approval by The determination of chemical hazard awareness among petrol tanker driver was conducted by evaluating the data through questionnaire survey and statistical analyses. The questionnaire was the modified form of the study conducted by Keith (2011). The questionnaire covered several sections where it will gather data on the duration of exposure to chemicals, the driver's lifestyle or health awareness and knowledge level regarding chemical hazard. The measurement of the questionnaire was based on Linkert scale, where the scale was based on a rating score of 1–5, as shown in Table 2 below. The study design and questionaires were approved by the ethics comitte of Universiti Kula Lampur (UniKL) Research Ethics Comittee.

2.2. Sample size

An anonymous questionnaire was administered to sixty-two respondents out of the seventy petrol tanker drivers in petrol tanker haulage company, namely, Konsortium PD (M) Sdn. Bhd, located Jalan Bukit Palong Lukut, Port Dickson, Negeri Sembilan. The haulage company is responsible to transport petrol product for Shell Malaysia, which covers Melaka, Negeri Sembilan, Johor and Pahang stats. A small batch consisted from four to six tanker drivers was given to answer the survey questionnaire conducted in-house at the company office during the change of shift from 12.00 pm until 1.00 pm from July 2017 until August 2017. The tanker driver was served an anonymous two pages questionnaire containing 27 questions assessing their knowledge on duration of work (7 questions), health awareness (8 questions) and chemical hazards exposures (12 questions), as presented in Tables 3, 4 and 5, respectively. For further details, please see the Supplementary Document.

2.3. Reliability test

A reliability test of Cronbach's Alpha using SPSS (SPSS software version 22.0) was performed to validate the questionnaire prior to the distribution to the respondents (Tavakol and Dennick, 2011). Cronbach's Alpha test was conducted with the reliability of the sum or average of q measurements that satisfy the parallel assumption with equal variance and covariance (Bonett and Wright, 2014). The q mesurement represent the questionare or it is reffered as internal consistency reliability of the test item (Cho and Kim, 2015). Pre-test for the pilot survey was conducted on ten random tanker drivers from the same company stated

Table 2
Linkert scale of the survey questionnaire.

Rating	1	2	3	4	5
Linkert Scale	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	Don't know	Harmless	Normal	Hazardous	very hazardous
	Always	Frequent	a few times	Rarely	never

Table 3
Frequency analysis for variable on duration of exposure.

No	Variables	Percentage (%)		
		18–35	36–45	46 and above
1	Tanker driver Ages	27.4	40.3	32.3
		Smoker	Non-smoker	
2	Tanker driver smoking habit	51.6	48.4	
		8 years and below	9 years an above	
3	Working experience as a tanker driver	66.1	33.9	
		Less than 8 hrs	More than 8 hrs	
4	Working hour in a day	45.2	54.8	
		Identified	Not identified	
5	How frequent did you identify spillage in a day	33.9	66.1	
		Always	Rarely/a few times/often	Never
6	How frequent did you notice/ smell the exposure identify due to spillage	19.4	41.9	38.7
		Yes	No	
7	Have you come into direct contact (touch/smell) with petrol during work	56.5	43.2	

above. The questionnaire's reliability was assessed with Cronbach's Alpha test using IBM Statistical Package for Social Science (SPSS) software. The analysis came out with the result of 0.85, indicating that variance in the scores is explainable.

2.4. Independent test

All statistical analyses were performed using SPSS (SPSS software version 22.0). Chi-square test was performed for testing the relationship of two categorical variables. Chi-suare test (x^2) was conducted based on the evidence of an association or not between two variables frequencies using contengency table (McHugh, 2012; Parkinson and Khan, 2018). The statistical formal for the Chi-square test is as followed:

$$x^2 = \sum \frac{(0-E)^2}{E} \quad (1)$$

Where *0* is the observed cell frequency, *E* is the expected cell frequency and Σ is the sum of all the cell in the contengency table.

Furthermore, Fisher exact correlation test was used to verify the existence of an association between age, duration of exposure, health awareness and knowledge level of respondents towards their chemical hazard awareness during working. The level of significant was chosen to be 0.05. The hypothesis of this study was developed to discover the awareness level of petrol tanker driver on their chemical working hazard by observing the correlation of each selected variables. The hypotheses for all possible combinations of various selected variables are:

Ho. There is no association between the two selected variables.

H1. There is an association between the two selected variables.

Table 4
Frequency analysis for lifestyle and health awareness.

No	Variables	Percentage (%)		
		Very healthy	Healthy	Neutral
1	Where do you think your health level is now	38.7	58.1	3.2
		Always	Rarely/a few times/often	Never
2	Experience symptoms such as dizziness/nausea during upload and offload	0	14.5	85.5
3	Did you do a health check/medical check-up	37.1	59.7	3.2
		Yes	No	
4	Does your employer provide medical support services	95.2	4.8	
5	Does the medical support provide to you is sufficient	88.7	11.3	
6	Do you have any illnesses such as asthma, tiredness, coughs	95.2	4.8	
7	Experienced a symptom which affects your health as a result from being exposed to chemical/petrol	24.2	75.8	
8	If you have frequent illness, fatigue, coughing, vomiting, do you think this condition is due to your work	11.3	88.7	

Table 5
Frequency analysis for knowledge on chemical hazard.

No	Variables	Percentage (%)		
		Yes	No	
1	Did you know what is chemical	100	0	
2	Did you know the danger of chemical	100	0	
3	Did you know petrol product contain chemical substance	100	0	
4	Did you know how you can be exposed to chemical substance	98.4	1.6	
5	Would you attend the class to understand hazardous chemicals	98.4	1.6	
6	Would you willing to change and adopt a safer work practice	100	0	
7	Safety equipment provided by your employer suitable	96.8	3.2	
8	Does wearing adequate safety equipment to protect you	93.5	6.5	
		4 names and below	5 names	
9	List of chemical name contained in petrol that you know	61.3	38.7	
		Normal	Dangerous	Very Dangerous
10	what is the level of danger when inhaled chemicals	1.6	17.7	80.6
		Strongly agree	Agree	Strongly disagree
11	Chemicals in petrol are harmful to humans because they are volatile	72.6	27.4	0
		Talking/ discussion	Reading materials	Classes/ training
12	How did you know about the danger of chemicals	1.6	12.9	85.5

3. Result and discussions

3.1. Duration of exposure

Data for the duration of exposure were summarized and presented as a percentage in Table 3. It was found that 27.4 % respondents were in the age group of 18–35 and 40.3 % respondents were in the age group of 36–45, while 32.3 % respondents were in the age group of 46 and above. This indicated that the company are employing tanker drivers who are at the prime age in their thirties with some experience in driving tanker or heavy vehicle and has lower probability of getting any health issues for optimum operation. Other studies shown that older employees had lower remaining years of service which employing and making investment such as training may not be essential (Bevan et al., 2014). The data also quantify that 66.1% respondent have less than 8 years working experience as a tanker driver and 33.9% has more than 9 years working experience shown in Table 3 (question 2). The trend is justifiable as there are fewer older driver in the company compared to younger driver older driver and younger driver will rationally have less working experience. Companies often employ younger people because of lower labour cost and they have higher drives to develop their career compared to older employees (Bertolino et al., 2011). Studies show that younger employees have a more proactive attitude to develop their career and have higher training motivation than older employees (Bertolino et al., 2011; Bevan et al., 2014). Other study showed that older drivers are associated slower reaction time, reduction in the surrounding sensitivity, poor at detecting hazard and lacking in physical fitness making them unsuited long distance driving (Yeung and Wong, 2015).

Several variables cover the awareness of petrol spillage or leakage while working indicating the frequency of exposure to petrol. Results shown in Table 3 for questions 5 indicated that 33.9% answered have identified spillage on a daily basis where the remaining 66.1 % did not. This variable can be represented as the frequency of spillage indicating that spillage does occur regularly making the contact time and concentration of exposure to the chemicals substantially higher. The result for questions 6 in Table 3 also shows that 38.7 % never notice any spillage by smell while 41.9 % smell the spillage a few times and 19.4 % always smell the spillage. Changes in sensitivity or responsivity can occur over time for a single individual exposed to the same concentration of a chemical which involved multiple variables such as duration of exposure and the frequency of exposure (Ju et al., 2018). Prior to the unloading of petrol to the station tank, Tanker worker is required to take samples out to verify the type of fuel that being unload by observing the colour of the product only using a simple metal bucket as a standard operating procedure (Syimir et al., 2018a). Fuel that was filled to the bucket is left out in the open which later transferred into the station tank after that batch of fuel finished unloaded. This could impair the capability to notify the spillage especially from smell due to high frequency of occurrence in addition contributing to higher exposure to petrol (Doty, 2015). The decrease of sensitivity and responsivity of an employee due to the impairment of sense such as smell could lead to inaccurate in situation awareness of their working conditions making them vulnerable to various type of hazard and possible working errors (Sætrevik and Hystad, 2017).

3.2. Health awareness

Many acute and adverse health effect had been associated with the exposure to petrol which signifies the magnitude of exposure to the particular chemicals. Collected data on the symptom of health effect while handling of petrol in Table 4 show that 14.5% answered a few times or rarely while 85.5 % choose never. Similar results are shown in Table 4 for questions 7 where the respondents are being asked whether they had experienced a symptom that affect their health as a result of being exposed to petrol shows that 75.8 % answered no whereas 24.2 % answered yes. The data shows that majority of the respondent did not have any symptom of health effect. Health effect of the exposure may be present if the targeted had been exposed frequently to the chemical for a prolonged time at high concentration (Cairney et al., 2002; Gericke et al., 2001; Hong et al., 2016; MOH, 2010). Thus, possible situation is where current concentration and rate of exposure to petrol may not reach to the level of exhibiting a short-term health symptom on the tanker driver (Damalas and Koutroubas, 2016; Gericke et al., 2001). Prolonged health effect could be studied by collecting data on short term exposure limit and time-weighted average of the exposure to determine the lifetime average daily dose for the exposure with the support of medical health data of the tanker driver (Shen et al., 2018). Many cases of occupational illness emerge after the employees had retired due to the risk of their occupation (Mukaida et al., 2017).

3.3. Knowledge on chemical hazard

Some variables comprise of respondent knowledge on chemicals and chemical hazards. The data in Table 5 show that 100 % of the respondent answered that they know what is chemical, the danger of chemical and that there are chemical contains in petrol. On the other hand, 38.7 % of the respondent can list 5 chemical names in petrol while 61.3 % could only list 4 or less chemical names. The results express from these 2 questions is that tanker drivers does have some knowledge on the product that they are working with. Some tanker drivers are knowledgeable than the other. Many of the answers provided by the tanker driver included hydrocarbons specifically benzene in the list indicated that they do have some knowledge regarding the risk of handling petrol product. 80.6 % of the respondents answered that they gain their knowledge by going through training and class and 17.7 % answered through reading whereas 1.6 % answered through discussion. This data specifies that training program is a suitable medium in providing knowledge to employees. Study shows that a short training session can improved employees knowledge and attitude of work for a short duration (Sokas et al., 2009). Niaz et al. (2015) stated that awareness level of a worker on occupational risk is closely related to providing proper knowledge and understanding of the subject. Providing an effective of training module would be the best recommendation to improve the awareness level of the tanker driver. Applying a module based on the capability to learn (education level) and practical implementation can further increase the understanding of the employees on chemical hazard (Sokas et al., 2009). A structured training program has been known to help improve a person skill and overcoming their weaknesses (Payal et al., 2017).

3.4. Independent test

The collected data were further analysed using Chi-square and Fisher exact for independence test to investigate the association between various variables using contingency tale for two categorical variables. The result of the Chi-square of the test for testing the correlations is prescribed in Table 6. The results obtained in Table 6 showing p-value for the correlations of each selected variables. The results show that some variables exhibited a strong association (p-value < 0.05) with other variables whereas the rest did not show a significant correlation at p-value >0.05. Chi-square test shows that the driver's age has a strong correlation with working experience and working hours. It is identified that older driver did have more experience as a tanker driver with p-value of 0.028 and frequently work longer hour in their shifts (p-value 0.038). This study shown that the company employed younger tanker drivers because of the advantages in physical fitness and low labour cost while keeping some older tanker driver for the task that requires experience such as long distance or secluded haulage trip (Bertolino et al., 2011; Underwood et al., 2013; Yeung and Wong, 2015). Employer may have put more trust on experienced driver for the longer and more time-consuming trip thus having longer working hours. In addition, experienced driver would have better working memory and has been

Table 6
Correlation table using Chi-square test.

No	Pearson Chi-Square Crosstab Analysis	P-value (2-tailed)	*Correlation
1	Drivers Age Vs. Smoking Habit	0.189	N
2	Drivers Age Vs. Driver Working Experience	0.028	S
3	Drivers Age Vs. Working Hour	0.038	S
4	Drivers Age Vs. Noticed of Spillage	0.05	N
5	Drivers Age Vs. Noticed of Spillage from Smell	0.237	N
6	Drivers Age Vs. Direct Contact with Petrol	0.052	N
7	Drivers Age Vs. Experience Any Health Issue from Chemical Exposure	0.101	N
8	Drivers Age Vs. Type of Chemical Known in Petrol	0.043	S
9	Drivers Age Vs. Illness That the Driver Have	0.037	S
10	Drivers Age Vs. Illness That the Driver Have Because Of Work	0.045	S
11	Smoking Habit Vs. Driver Working Experience	0.554	N
12	Smoking Habit Vs. Working Hour	0.07	N
13	Smoking Habit Vs. Noticed of Spillage	0.323	N
14	Smoking Habit Vs. Noticed of Spillage from Smell	0.136	N
15	Smoking Habit Vs. Direct Contact with Petrol	0.29	N
16	Smoking Habit Vs. Experience Any Health Issue from Chemical Exposure	0.104	N
17	Smoking Habit Vs. Type of Chemical Known in Petrol	0.685	N
18	Driver Working Experience Vs. Working Hour	0.084	N
19	Driver Working Experience Vs. Notice of Spillage	0.165	N
20	Driver Working Experience Vs. Notice of Spillage from Smell	0.04	S
21	Driver Working Experience Vs. Direct Contact with Petrol	0.032	S
22	Driver Working Experience Vs. Experience Any Health Issue from Chemical Exposure	0.132	N
23	Driver Working Experience Vs. Type of Chemical Known in Petrol	0.3	N
24	Working Hour Vs. Notice of Spillage	0.794	N N
25	Working Hour Vs. Notice of Spillage from Smell	0.154	N
26	Working Hour Vs. Direct Contact with Petrol	0.044	S
27	Working Hour Vs. Experience Any Health Issue from Chemical Exposure	0.006	S
28	Working Hour Vs. Type of Chemical Known in Petrol	0	S
29	Notice of Spillage Vs. Notice of Spillage from Smell	0.534	N
30	Notice of Spillage Vs. Direct Contact with Petrol	0.035	S
31	Notice of Spillage Vs. Experience Any Health Issue from Chemical Exposure	0.498	N
32	Notice of Spillage Vs. Type of Chemical Known in Petrol	0.023	S
33	Notice of Spillage from Smell Vs. Direct Contact with Petrol	0.708	N
34	Notice of Spillage from Smell Vs. Experience Any Health Issue from Chemical Exposure	0.008	S
35	Notice of Spillage from Smell Vs. Type of Chemical Known in Petrol	0.066	N
36	Direct Contact with Petrol Vs. Experience Any Health Issue from Chemical Exposure	0.033	S
37	Direct Contact with Petrol Vs. Type of Chemical Known in Petrol	0.066	N
38	Experience Any Health Issue from Chemical Exposure Vs. Type of Chemical Known in Petrol	0.013	S

* Correlation is significant at P-value < 0.05 (2 tailed); S: Significant; N: Non-significant.

familiar with the route and travelling condition which improved the efficiency of the transportation of the trip (Bellet and Banet, 2012). On the other hand, there is no significant correlation between the driver's age and the ability to identify spillage and having any symptom of health issues in result of chemical exposure shown in Table 5 for correlations No 4 and 5. This feedback is an agreement with the finding of this study showing that age plays a vital role in measuring the level of hazard awareness on an individual (Bertolino et al., 2011).

Driver working experience also displayed a strong correlation with other variables. Correlation analysis shows driver working experience has a strong correlation significant on the driver's ability to identify spillage via smell with p-value 0.03 significant difference where less experience driver notices the spillage through smell more than much experience worker. This finding further supports the result in Table 3 where the sensitivity of an individual towards chemical exposure depends on the duration of exposure and the frequency of exposure (Damalas and Koutroubas, 2016). Prolonged and frequent exposure to the target chemical may have reduced the senses of an individual to notice the presence of the component in their surroundings because of sensory adaptation (Shen et al., 2018). A study shows that human olfactory function will decline and start to lose the ability to sense smell as a person grew older could be one of the factors that disable experience worker to detect spillage from their sense of smell (Boyce and Shone, 2006). Psychological study state that sense of smell was easily dominated by the sense of sight (vision) and the olfactory function frequently unable to identify the changes in the surrounding due to this behaviour (Menzel et al., 2019).

The findings obtained show that driver working hours have a strong correlation in several other variables. The results show that drivers who work long hour had the tendency to come into direct contact with petrol at 0.044 p-values. Drivers that work longer hours will have higher probability to have been in contact with petrol as they spend more time with the product compared to driver that work fewer working hours. The variable also illustrates a strong correlation with the driver experience any health issue from chemical exposure with a p-value of 0.006. Tanker drivers that work longer hour were identified to have experienced health symptom or the tendency to feel unwell due to the exposure of chemical. Having to work longer hour means the driver have a higher probability to encounter the chemical compared to driver that work less thus increase the frequency and the duration of chemical exposure making the driver to experience health symptom (MOH, 2010; Rajan and Malathi, 2014). Prolonged and frequent exposure could be the caused for the driver to exhibit the health symptom given that those who work longer hours is the older and more experienced driver shown in the correlations 3 in Table 6 (Bevan et al., 2014; MOH, 2010; Renner et al., 2015). Correlation 36 in Table 6 further support these findings where tanker driver that answered never come into direct contact with petrol did not experience any health issue with strong correlation p-value of 0.033.

Variable on the driver ability to identify spillage had shown strong correlation with several other variables in the study. Correlation 34 in Table 6 displays a strong correlation significant with p-value of 0.035 where driver who is frequently come into direct contact with petrol cannot identify the spillage had occurred during working (Boyce and Shone, 2006; Shen et al., 2018). Tanker driver may be unable to identify the spillage due to the impairment of the sense such as smell due to constant contact with petrol (Menzel et al., 2019). The sensitivity and the responsivity of a person to identify the changes in the working environment varies and largely related to the different exposure history of a person stated in the frequency analysis (Doty, 2015; Sætrevik and Hystad, 2017). On the other hand, the drivers may have different opinion on spillage or leakage based on their risk perception and situation awareness where they only considered large quantity of petrol loss as spillage whereas a small quantity of petrol leaks as normal condition of their work because of the frequency of small spillage may occurred to frequently as shown in the frequency analysis of question 6 Table 3 (Renner et al., 2015; Sætrevik and Hystad, 2017).

3.5. Behaviour based safety related to hazard awareness

Behaviour-based safety is a technique that emphases on the employee's behaviour regarding occupational safety. Linking the selected

variables of this study on the worker behaviour point of view could further understand the bigger picture on the level of awareness of the tanker driver on chemical hazard. A study on the relationship of proactive personality based on age with training motivation, perceived career development shows that younger employees have a more proactive attitude to develop their career and have higher training motivation than older employees (Bertolino et al., 2011; Bevan et al., 2014). Older employees are not interested to further their career because of low remaining years of service which making the investment put on training may not be essential (Randstad, 2002). Furthermore, companies often decided to leave out older employees from training their plan (Lord and Farrington, 2006). According to Randstad (2002), older employees are often disregarded from training and career development by the employer Only 3 out of 10 companies included older worker in their training plans (Lord and Farrington, 2006). Younger employees have higher drives to develop their career compared to older employees (Bertolino et al., 2011; Bevan et al., 2014; Kanfer and Ackerman, 2004). A study shows that younger employees have a more proactive attitude to develop their career and have higher training motivation than older employees (Bertolino et al., 2011; Bevan et al., 2014). Taubman-Ben-Ari and Findler (2005), found that older people from age 51 to 65 had a lower intention of engaging healthy behaviour and lifestyle compared to younger people from the age group of 36–50.

Risk among drivers identified that most drivers have a precise perception on driving risks, but they also believe that these risks do not apply to them personally which they are less likely to get into an accident (Deery, 2013; DeJoy, 1989; Holland, 1993; Lichtenstein et al., 1978). Overestimation or overconfidence is a significant source of prejudice in the awareness of the risk that can influence people in both negative and positive ways which can result in lower awareness level (Deery, 2013). Studies suggest that human attempt to reduce risk and threat by removing the bad thought and replacing it with an alternate thought which having to think the risks are not related to them (Bevan et al., 2014; Deery, 2013; Taubman-Ben-Ari & Findler, 2005). Psychological behaviour such as not caring or not directly related to the problem could have caused this situation to occur.

Providing a Health management program especially to older worker to increase their awareness level of tanker driver and relate the effect an impact of chemical hazard (Bevan et al., 2014). This can help older worker to feel appreciated and provide moral support to continue improving on their working skill because the workers know that they are appreciated by the company. Applying cognitive method in further understanding the awareness level of chemical hazard of the petrol tanker driver can provide a psychological view of the tanker worker in adopting the knowledge from the training into practice while working. This can also provide information to the company on the effectiveness of the training and decide to improve the worker awareness level by having a different approach such as changing the module of training or providing a different type of material to supply the information on chemical hazard to the worker as the result indicate that the driver had most of the information and knowledge from training provided to them.

4. Conclusion

Selected variables in the study were classified into three parts, duration of exposure, lifestyle or health awareness, and knowledge on chemical hazard. Frequency analysis and contingency table were used to find the significance between the selected variables. The Age variable showed that the company are employing tanker drivers who are at the prime age in their thirties with some experience in driving tanker. 85.5 % of the respondent answered they never experience any symptom of health effect in the course of handling the petrol product indicated that the drivers are generally healthy. Chi-square test indicated several variables such as Tanker driver age, the driver working experience and the driver ability to identify spillage had shown strong correlation with other variables. Older driver tends to exhibit problem with health issues due to longer working hours and prolonged exposure to petrol. Alternatively, less experienced driver is capable to notices the spillage through smell more than much experience worker. The findings discovered that driver who is frequently come into direct contact with petrol cannot identify the spillage had occurred during working which indicated the reason why experienced driver is incapable of identifying spillage. The study identified that training program is appropriately approached in providing knowledge to the tanker driver. Changing the module of training suitable to the level of the worker with hands-on methods or providing a different type of material to supply the information on chemical hazard could enhance the tanker driver knowledge subsequently increase their awareness on chemical hazard.

Declarations

Author contribution statement

Ahmad Noor Syimir Fizal: Conceived and designed the experiments; Wrote the paper.

Md. Sohrab Hossain: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Abbas F.M. Alkarkhi, Siti Rahayu Mohd Hashim: Analyzed and interpreted the data.

Adeleke Abdulrahman Oyekanmi, Nor Afifah Khalil: Performed the experiments.

Muzafar Zulkifli: Contributed reagents, materials, analysis tools or data.

Ahmad Naim Ahmad Yahaya: Conceived and designed the experiments.

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The authors declare no conflict of interest.

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