

A Study on Chemical Management in a Tire Manufacturing Industry

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Abstract: Chemical Management is a safe process in the supply chain that requires adequate protection of workers and the environment through proper care in the delivery, use, storage and disposal of chemicals. If the safety practices that have been established in Chemical Management are not used or practiced in the daily work process, various accidents or injuries may occur to employees. The use of chemicals in tire production in large quantities if not controlled in terms of handling and storage can result in unexpected accidents. The following is an objective based on the problem statement that has been given, to identify pre-training knowledge about chemical management and determine post-training knowledge about chemical management. After that, analyze the data based on the pre- and post-questionnaire related to Chemical Management Training. Employees who work with chemicals must attend training on chemical disposal. Next, survey questions were also given to the employees who attended the training in the form of Pre and Post which the employees had to answer online. Next, the Statistical Package for the Social Science (SPSS) was used to analyze the data obtained based on the survey questions. The result obtained based on the analysis made is that the training that has been given to the employees has achieved good effectiveness. The importance of this study is to provide a way how to improve the safety and health of workers who are exposed to dangerous chemicals. This study can also provide new knowledge to employees about the importance of chemical management for work processes that involve chemicals in order to improve safety in the workplace.

Keywords: Chemical Management, Handling & Storage Chemical, Training
Chemical Management, Pre & Post Questionnaire related Chemical Management

1.0 Introduction

With the chemical industry being one of the world's most important industrial sectors, government regulators face a variety of challenges that may harm the environment, human health, government finances and the growth of a corporation. The use of unsuitable equipment, which leads to equipment breakdowns, is one of the leading causes of chemical mishaps in the workplace. Chemical accidents are more likely to occur when an unskilled employee handles or comes into contact with chemicals in the workplace. This is known as an operator error, and it may result in a slew of chemical safety hazards not just for the operator but also for the entire workplace. When it comes to safely handling hazardous chemicals, most operator mistakes are caused by a lack of understanding or training.

Meanwhile, the following is the objective of the study that has been made, to identify pre-training knowledge about chemical management and determine post-training knowledge about chemical management. After that, analyze the data based on the pre and post-questionnaire related to Chemical Management Training.

2.0 Materials and Methods

Research planning was done at the early stage of this study and proceeds with research design and analysis. Past studies, journals, research and some documents in the EHS Department have been collected to get a better understanding of this study, especially in relation to chemical management. It all has to do with the issue of chemicals.

The study population and data collection methods were discussed with the supervisor. In order to achieve the stated objectives, a set of questionnaires was made to be given to the targeted respondents. In addition, chemical management training is also conducted for related employees. The data was then analyzed using Statistical Package for the Social Science (SPSS) software to achieve the objectives of the study. The flow chart of the study is as show in figure 1:

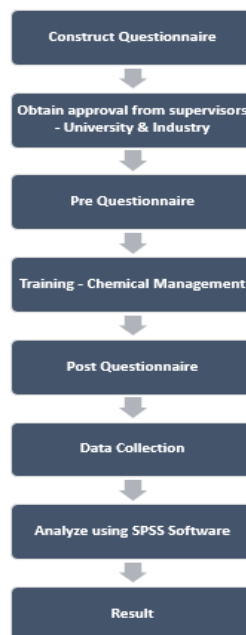


Figure 1: Research flowchart

3.0 Results and Discussion

Data was analyzed using the SPSS to facilitate the analysis process. The statistical methods used for data analysis are descriptive statistics and inferential statistics. Before the pre and post questionnaires were given to the respondents, a pilot test involved a total of 15 respondents who were randomly selected from production workers. After the pilot test data has been collected, the question also uses a reliability test to ensure that the questions that will and have been answered by the respondents can be used and get an average above 0.7. After the pilot test was completed, the survey questions were given to the respondents, the questions also used a reliability test to ensure that the questions answered by the respondents can be used and get an average above 0.7. Based on the reliability test that has been made based on the questions that will be given to the respondents, the value for the pre-survey question gets a value above 0.7 and reaches the appropriate standard.

The reliability of the pilot test, pre and post questionnaire was tested using the Cronbach alpha method. Found a value of $\alpha=0.703$ which shows a high significant reliability for the set of questionnaires.

Table 1: Cronbach’s Alpha (Pilot Test)

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.715	.637	15

Table 2: Cronbach’s Alpha (Pre)

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.703	.669	15

Table 3: Cronbach’s Alpha (Post)

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.703	.726	5

Populations of company are 700 people and need to get a sample size of 248. Because the researcher was conduct training and limited capacity when doing training for one place. In addition, most workers involved with chemicals involve production workers. So the response rate available is only 30 respondents. Questionnaires were given to respondents before and after training. Questionnaires are given in an online form which is Microsoft form. Meanwhile, table 4 show the departments involved in the survey and participating in the training, table 5 show the schedule that has been released for the training & table 6 shows the total attendance from each department.

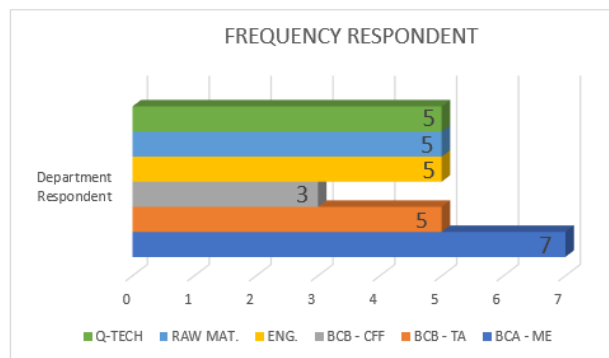
Table 4: List of Department

Department
Business Centre A (BCA) – Mixing & Extruder (ME)
Business Centre B (BCB) – Tire Assembly (TA)
Business Centre B (BCB) – Curing & Final Finishing (CFF)
Warehouse & Raw Material
Engineering & Facilities
Quality

Table 5: Schedule Training

Schedule Training Chemical Management				
Date	Department	Pax	Room	Time
13/12/2022	Business Centre A (ME)	7	Wrangler	10:00 AM
14/12/2022	Business Centre B (TA)	3	Wrangler	1:00 PM
	Business Centre B (CFF)	3		
15/12/2022	Engineering	5	Eagle	10:00 AM
	Quality	5		
16/12/2022	Business Centre B (TA)	3	Eagle	10:00 AM
	Raw Material	5		

Table 6: Frequency respondent for attendance



The Kolmogorov-Smirnov and Shapiro-Wilk tests are used to determine the normality of data. Because the total number of respondents in this study was 30, which is an element of $N < 50$, the Kolmogorov-Smirnov test was used in this project. If $p > 0.05$, the data is considered normal. $P > 0.05$, on the other hand, indicates that the data is not normal. p values are denoted as "Sig" in SPSS. Table 7 below shows the data that has been obtained based on the normality test.

Table 7: Test of Normality

	Tests of Normality						
	Statistic	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		c	df	Sig.	Statistic	df	Sig.
CM1	.488	30	<.001	.492	30	<.001	
CM2	.	30	.	.	30	.	
CM3	.	30	.	.	30	.	
CM4	.	30	.	.	30	.	
CM5	.406	30	<.001	.612	30	<.001	
CM6	.392	30	<.001	.643	30	<.001	
CM7	.	30	.	.	30	.	
CM8	.	30	.	.	30	.	
CM9	.	30	.	.	30	.	
CM10	.306	30	<.001	.733	30	<.001	
CM11	.	30	.	.	30	.	
CM12	.492	30	<.001	.466	30	<.001	
CM13	.	30	.	.	30	.	
CM14	.	30	.	.	30	.	
CM15	.	30	.	.	30	.	

a. Lilliefors Significance Correction

After the data obtained from the respondents for the pre and post questionnaire, the data will be compiled to obtain the Mean Score. Table 8 below shows the mean score for the Pre and Post questionnaires that have been received after using SPSS. Based on the table below showing the total mean scores for the pre and post survey questions which are slightly different. Based on this finding it shows that the employees in this company know and understand about chemical management in an industry.

Table 8: Mean score for questionnaire

Question	Min Score (Pre)	Min Score (Post)
CM 1	1.87	1.00
CM 2	1.67	1.00
CM 3	2.77	3.00
CM 4	1.47	1.00
CM 5	1.73	2.00
CM 6	2.20	3.80
CM 7	2.53	3.00
CM 8	2.47	3.00
CM 9	2.70	3.00
CM 10	2.13	2.53
CM 11	2.10	2.00
CM 12	2.40	2.90
CM 13	2.27	1.00
CM 14	1.70	2.00
CM 15	1.63	1.00
Min	2.11	2.15

T-test analysis was conducted on pre and post questionnaires. This test is carried out with the aim of whether the hypothesis is accepted or rejected. The researcher has analyzed the t-test on the comparison of pre and post questionnaire test samples that have been answered by the respondents. Table 9 below shows results of the t-test that has been made for the pre and post questionnaire. Based on the table, the mean difference for the pre and post questionnaire is only 0.04 points. The -t value after calculating the sample comparison of the two questionnaires is -0.490 and the significant p value for both tests is 0.628. The significance level is greater than 0.05 ($p > 0.05$). Therefore, the null hypothesis (H_0) is accepted. So, there is no significant difference for pre and post questionnaires for chemical management training.

Table 9: T-test analysis for questionnaire

Questionnaire	N	Mean	Df	-t	Sig.P
Pre	30	2.11	29	- 0.490	0.628
Post	30	2.15			

4.0 Conclusion

The question given to employees is to measure their knowledge of Chemical Management which includes the handling and storage of chemicals in the factory. Based on the information gathered, it was found that there are still many workers who do not practice safe work for handling and storage work. In addition, they still do not understand the importance of Chemical Management in their daily work process. Among the limitations faced when doing research to identify the tire manufacturing industry using safe or not methods in the storage, handling and disposal of chemicals to reduce the risk to safety, health and the environment is the time constraint in identifying the number of workers who work with chemicals. Among the recommendations that have been made is to reduce the number of employees who need to answer questionnaires. For questions only focus on handling, storage and basic knowledge of Chemical Management.

The training has involved 30 workers who work with chemicals for handling and storage only. However, in the training, the basic management of chemical substances was also conveyed to the employees who attended the training. In addition, before and after the training,

participants have to answer pre and post questions that have been prepared. The question given to the participants is to measure their knowledge about the management of chemicals in the factory and after undergoing training, the same question will be given to measure their understanding of the management of chemicals that has been explained to them. Due to the number of people present for the training being 30 people, it required a large room, but the room had been booked by another department to conduct training for a week. In addition, this recommendation is also made because there is not enough room or room to accommodate 30 straight, so a schedule needs to be made to make room reservations so that there are no problems when the training is carried out.

In conclusion, chemical management practices are very important in any industry, especially industries where chemicals are present. In addition, workers also need to be exposed to chemical management so that workers are more careful when handling or storing processes that involve chemicals. If there is an emergency, workers are better prepared to handle it because it has been revealed how to wash chemicals that have been spilled or burned through chemical management.

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